

# Husbanding the Land



Agricultural Development and  
Socio-technical Change in Luoland, Kenya

Nelson A.R. Mango

## Propositions

1. Ruthenberg's (1980) model on the transformation of agriculture was a general one, but fits remarkably well with the transformation of Luo agriculture (*this thesis*)
2. We need to go beyond the second soil fertility paradigm as formulated by Sanchez (1999) (*this thesis*)
3. It is artificial to distinguish between sociology and agronomy, and harmful to separate them (*this thesis*)
4. The proof of the pudding is in the eating. Therefore, researchers who claim that their work is relevant for the improvement of agriculture in the tropics should be given the obligation and the opportunity to test their ideas and put them into practice (Lagrotech plant breeder) (*this thesis*)
5. Development is neither linear nor cyclical. It is complex and a rather chaotic process that involves the mixing of various socio-technical regimes, and is accompanied by iterative learning processes (*this thesis*)
6. It is human instinct to produce what one eats irrespective of the level of technology. This is why Luo farmers interpret relying on the market for food as a stage of mental instability (*this thesis*)
7. Just like a car warns the driver of an impending mechanical breakdown, the soil also warns the farmer of its fertility status through change of crop performance, soil colour, texture, odour and the type of weeds that grow in it.
8. Striga weed is as patient as a vulture. Its seeds can stay in the soil for as much as a hundred years. But the moment a farmer grows a cereal crop, they will show up. *Oketch Bundmawi (Muhanda village)*
9. Once you know your obligations, you can survive. *Ogwang Madara (Muhoho village)*

Propositions presented with the doctoral dissertation *Husbanding the land: Agrarian development and socio-technical change in Luoland, Kenya* by Nelson A.R. Mango, to be defended on Wednesday 20<sup>th</sup> March 2002, 13.30 hrs at the 'Aula' of Wageningen University



# **Husbanding the Land**

## **Agrarian development and socio-technical change in Luoland, Kenya**

CENTRALE LANDBOUWCATALOGUS



0000 0924 9711



**Promotor:**

Prof. Dr. N. E. Long  
Hoogleraar in de Ontwikkelingssociologie  
Wageningen Universiteit

**Co-promotor:**

Dr. P. G. M. Hebinck  
Universitair docent bij de leerstoelgroep Rurale Ontwikkelingssociologie  
Wageningen Universiteit

**Promotiecommissie:**

Prof. Dr. J. Pottier  
University of London  
Prof. Dr. ir. J. D. van der Ploeg  
Wageningen Universiteit  
Prof. Dr. P. Richards  
Wageningen Universiteit  
Prof. Dr. ir. E. Smaling  
Wageningen Universiteit

0208201, 3166

## **Husbanding the Land**

# **Agrarian development and socio-technical change in Luoland, Kenya**

Nelson A. R. Mango

Proefschrift

Ter verkrijging van de graad van doctor

Op gezag van de rector magnificus

van Wageningen Universiteit,

Prof. Dr. ir. L. Speelman

in het openbaar te verdedigen

woensdag 20 Maart, 2002

des namiddags om 13.30 uur in de Aula

1643423

Mango, N. A. R.

Husbanding the Land: agrarian development and socio-technical change in  
Luoland, Kenya

ISBN: 90-5808-604-6

Copyright © 2002 by N. A.R. Mango

**For Rachael**



## Table of Contents

Figures and Tables	xii
Abbreviations	xiii
Acknowledgements	xv
Preface	xix
<b>Chapter 1. Research Context and Setting</b>	<b>1</b>
Introduction	1
The Setting	3
The research villages	4
Agricultural development and change in Luoland: A theoretical perspective	8
An actor oriented perspective	11
Interlocking and Distancing	12
Distancing, knowledge and knowledge networks	13
Power and strategic agency	15
Technology, socio-technical regimes and socio-technical networks	16
Cultural repertoires and socio-technical regimes	23
Methodological considerations	25
Case studies	26
Ethnographic interviewing	28
The study of genealogies, critical events and life histories	29
The survey	30
Secondary data collection	30
Level and unit for research	30
Organisation of the book	31
<b>Chapter 2. Agrarian Development and Change in Luoland</b>	<b>35</b>
Introduction	35
The Pre-colonial Period	36
The Colonisation of Luoland	37
The period 1895-1930	37
1930s until Independence	43
The Second World War and Beyond	46
Post War Policy	48
The Swynnerton Era - the 1950s	49
The Post-Independence Period (1964-present)	52
Conclusion	57

<b>Chapter 3: Kinship, land and agricultural practices among the Luo</b>	<b>61</b>
Introduction	61
The Ancient Luo Villages	62
Kinship relations	69
Luo customary land tenure arrangements	72
Land allocated to clansmen	72
Land allocated to strangers	73
Land allocated to slaves	74
The inheritance of land: the customary law	74
Inheritance of land in a polygamous complex	76
Labour relations	76
Kinship, culture and the seed	79
The <i>Golo Kodhi</i> (first sowing) and the <i>Dwoko Cham</i> (first harvesting)	79
Principles	
Land inheritance, labour relations and agricultural practices in reality	82
Discussion and conclusions	108
 <b>Chapter 4: Socio-technical regimes, networks and the spread of maize in Luoland</b>	 <b>111</b>
Introduction	111
Socio-technical networks and the proliferation of maize in Luoland	112
Maize selection, breeding and networks	120
Breeding through mass selection	121
Hybrid maize breeding and selection	123
Intervention and initial adoption of hybrid maize in Siaya	129
Mass selection of local maize and hybrid maize breeding compared	137
Characteristics of maize	141
Characteristics of local maize varieties	141
Characteristics of hybrids	144
The dominance of local maize in peasant farmers' preferences	146
Conclusions	150
 <b>Chapter 5: Responses to hybrid maize intervention in Luoland: redesigning and distancing</b>	 <b>153</b>
Introduction	153
Contemporary patterns of hybrid maize production	153
The redesigning of the hybrid maize technology package	155
Distancing	161
Market/institutional Failures	161
Agonomic characteristics of hybrid maize	168



Socio-cultural issues	174
How farmers distance themselves: networks and struggles	178
Family/Kinship networks	178
Neighbours and Friends	180
Gender	181
Class	182
Trade	182
Community organisations	183
Struggles to maintain the genetic base of local maize	184
Conclusion	185
 <b>Chapter 6: Soil fertility problematic in Luoland</b>	 <b>189</b>
Introduction	189
State policies in soil fertility and conservation	190
Policies in soil and water conservation during the colonial period	190
Soil and water conservation policies after independence	193
Mineral fertiliser policy	194
Liberalisation	196
Perceptions of the impact of liberalisation policies	196
Local knowledge and soils	198
Soil classification and soil fertility management	198
Farmers' criteria for assessing soils	198
Farmers' indicators of soil fertility	199
Farmers' soil conservation and nutrient management practices	200
Minimising nutrient losses	201
Crop residue utilisation and mulching	202
Inorganic fertilisers	203
Use and management of organic manure	205
Agronomic practices	206
Using intra-field soil fertility variations	207
Swamp development for vegetable production	207
Off-farm employment and migration	208
Conclusions	209
 <b>Chapter 7: Soil fertility, manure and milk</b>	 <b>213</b>
Introduction	213
Background of the National Dairy Development Project	213
The zero grazing concept	215
Dairy farming and zero grazing in Siaya	219
Zero grazing in practice	222
Farmers' redesigning practices	222

Housing (the zero-grazing unit)	223
The introduction of improved dairy cattle breeds	224
Artificial insemination services	225
Fertility	225
The production of high yielding fodder (e.g. napier grass) on the farm itself	227
Feeding of dairy cows on concentrates and minerals	228
Utilisation of Farm Yard Manure and artificial fertilisers to maintain soil fertility	231
Clean milk production	323
Knowledge and social networks for redesigning	234
Conclusion	239
<b>Chapter 8: Agro-forestry innovations: a second soil fertility paradigm?</b>	<b>241</b>
Introduction	241
The background of SFRRP in Western Kenya	242
The Second Soil Fertility paradigm in practice	245
Green manuring and transfer of biomass	245
Improved, short duration fallow technology	248
Farmers perceptions of green manure technology	251
Farmers perceptions of improved fallow technology	251
Luero: the ICRAF village	257
The success of SFRRP in Luero village	259
Zedekia Ooko Munyore: a successful adopter who lost out	262
Agro-forestry innovations: a solution for women farmers?	266
Reasons for adopting improved fallow by women farmers	266
Constraints to the adoption of SFRRP technology by women farmers	270
An analysis of actor's perceptions of SFRRP technologies	272
A dairy farmer's perception	272
MOALD Extension Worker's perception	272
An international research scientist's perception	274
Contextualising the second soil fertility paradigm	276
Conclusion	279
<b>Chapter 9: Agrarian development and socio-technical change in Luoland</b>	<b>283</b>
Introduction	283
The main argument: a theoretical reflection	283
The ethnography of technology: husbanding the land	286
Culture and agricultural practices	287

Socio-technical regimes and maize in Luoland	290
The soil fertility domain and paradigmatic change	291
The response of the State and NGOs to distancing	293
Luo farming practices: looking at the future	295
 Bibliography	 297
Samenvatting	311
Glossary of Luo words	319
Curriculum Vitae	321

## Figures and Tables

Figure 1. Spatial ecology of a Luo homestead	72
Figure 2: The descendants of Olum	85
Figure 3: the descendants of Ogonda I	92
Figure 4: the descendants of Opiyo Naki	94
Figure 5: Descendants of Rateng	97
Figure 6: The descendants of Oyola	100
Figure 7.1. Lay out of the zero-grazing unit floor plan	216
Figure 8.1: The layout of Zedi's field in 1998 Long Rains	264
Map 1: Map showing the location of Siaya in Western Kenya	4
Map 2: Siaya District and the location of the research villages	6
Table 2.1: Labour recruitment in Nyanza between 1914 and 1917	
Table 4.1: Socio-technical networks of maize in Luoland	116
Table 4.2. The prescribed hybrid maize technology package	130
Table 4.3 Recommended hybrid varieties of maize per agro-ecological zone by KARI	130
Table 4.4: Choice of local composite seed in Muhanda, Nyamninia and Muhoho Villages	147
Table 5.1. Type of maize grown by farmers per village	154
Table 6.1: Main soil types	199
Table 8.1: Number of farmers experimenting with improved fallowing and transfer of biomass in the three villages (1998)	251

## Abbreviations and Acronyms

AFC	Agricultural Finance Corporation
AFRENA	Agroforestry Research Network for Africa
AGRINOVIM	AGRIcultural Innovation, Novelty and regIMes
AHA	Animal Health Assistant
AIDS	Acquired Immune Deficiency Syndrome
AMREF	African Medical Research Foundation
ARF	Adaptive Research Farmer
CAN	Calcium Ammonium Nitrate
CARE	Co-operation of American Relief Everywhere
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	Centre for the Improvement of Maize and Wheat
CPK	Church of the Province of Kenya
DCPR	Dairy Cattle Research Project
DDT	Dichloro-Diphenyl Trichloroethane
DEAF	Dairy Evaluation and Advice Form
E.A.S	East African Standard newspaper
ECA	East and Central Africa
FAO	Food and Agricultural Organisation of the United Nations
FTC	Farmers Training Centre
FURP	Fertiliser Use Recommendation Project
GoK	Government of Kenya
GRP	Group Resource Person
HIV	Human Immuno-deficiency Virus
ICRAF	International Centre for Research in Agroforestry
IMF	International Monetary Fund
KANU	Kenya African National Union
KARI	Kenya Agricultural Research Institute
KCC	Kenya Co-operative Creameries
KEFRI	Kenya Forestry Research Institute
KFA	Kenya Farmers Association
KGGCU	Kenya Grain Growers Co-operative Union
KNA	Kenya National Archives
KEPHIS	Kenya Plant Health Inspectorate Services
KPU	Kenya Peoples Union

KSC	Kenya Seed Company
KShs	Kenya Shillings
Lagrotech	Lowland agricultural technologies
LUTATCO	Luo Thrift and Trading Corporation
MDC	Maseno Double Cobber
MOALD	Ministry of Agriculture and Livestock Development
NAHRS	National Animal Husbandry Research Station
NARC	National Agroforestry Research Centre
NCPB	National Cereals and Produce Board
NDDP	National Dairy Development Project
NGO	Non Governmental Organisations
OFPEP	On-Farm Productivity Enhancement Programme
OPV	Open Pollinated Varieties
PRA	Participatory Rural Appraisal
R&D	Research and Development
RP	Rock Phosphate
SCODP	Siaya Community Oriented Development Programme
SFRRP	Soil Fertility Replenishment and Recapitalisation Project
SIDA	Swedish International Development Agency
spp.	Species
SWC	Soil and Water Conservation
T&V	Training and Visit
TATE	Technical Administrative Task Environment
TSP	Triple Superphosphate
VAT	Value Added Tax

## Acknowledgement

This thesis is the outcome of the Wageningen University and Research Centre Sandwich Scholarship Programme. I am indebted to the University administration for this scholarship. As the scholarship could not cover all the necessary costs required for a Ph.D project, there are many other organisations I would like to thank for their help in financing both my fieldwork and the final writing up. First my appreciation to Prof. A.W. Van den Ban and his colleagues in the *Stitching Redelijk Studeren Foundation* for the assistance and support they gave me from the beginning of my Ph.D fieldwork to the final writing of the thesis. The same I extend to Rev. Josine van der Horst, chaplain to international students in Wageningen. In Kenya, I must thank most sincerely the various institutions that offered me affiliation and support. I would like to thank the Centre Director of KARI, the Kakamega Regional Research Centre, the Centre Director of NARC, Maseno, and the Netherlands Liaison office at KARI headquarters Nairobi.

So many people have contributed to the production of this book. To the farmers of Nyamninia, Muhanda, Muhoho and Luero villages I am especially indebted. They gave me information, showed me tolerance and offered me their hospitality, for all of which I am most grateful. My promoter Prof. Norman Long has been an excellent supervisor. Knowing the intellectual and time pressures involved in the Ph.D process, he always released his advice at the right time and retained some for another day. He always engaged me in friendly discussions with lots of sense of humour that made me feel relaxed and at home. Part of his supervision included engaging me in serious telephone conversations at any time of the day and electronic mail.

Dr. Paul Hebinck was more than just a co-promoter. He doubled as my guardian. From the moment I entered Wageningen University for the MSc programme he engaged me in academics. He was also prompt in helping with any practical problems that arose both in the field and during thesis writing. This reminds me of the several field visits he made in Kenya just to ensure that I was on the right track. Beyond his valuable contribution to the contents of this book through reading and commenting on all the versions, Paul, with enthusiasm and faith in my progress, overviewed my intellectual development. This included our publishing papers together and reading and commenting on the papers I published alone. Paul sent two of his students, Coen van Kessel



and Maria Verkerk, to be my co-researchers for a short period. I would like to thank them as they were of real help to me. They independently verified the things I have discussed in this thesis.

I would also like to thank Prof. Eric Smaling of the Soil Science Department for the financial support he offered me through NUTNET. He also visited me in the field and offered valuable suggestions on matters pertaining to soil fertility replenishment. One of his students in soil science, Gert Jager, carried out soil sampling and tests for the plots in the research villages. I am grateful to Gert as his work independently confirmed my findings based on farmer accounts.

Ann Long showed interest in my work at an early stage. I am particularly lucky that she was willing to make time during a very busy period in her life to skilfully edit this thesis. I am also grateful for the several generous invitations to their home. I owe a lot to members of the department of Rural Development Sociology whose relentless support I enjoyed from the time I joined the department to the end. Jos Michel was always there to help. The lecturers of this department played a very big role in moulding me into a sociologist right from the time of my MSc programme in Wageningen. I wish to thank Jan den Ouden, Alberto Arce, and Gerard Verschoor, for their intellectual inputs. I also want to thank Jens Anderson, Gemma van der Haar, Flip van Helden, Edwin Rap, Dorothy Wartena, Woldeap Teshome, Fidencio Servin, Pablo Laguna for being part of a good Ph.D family on the third floor. Jens Anderson assisted with drawing the genealogies that are in chapter 3. I must also thank Deanne van Nederveen for help with drawing the maps. Franz Huijzendveld of the Rural History group commented critically on an early draft of chapter 2. Willem van Weperen, of ETC, once involved in implementing NDDP in Kenya, read my chapter seven and made valuable comments.

I would also like to thank friends in Holland who made a contribution to my well being: My contact family members, Mr. and Mrs Jan van Kessel, their children Giel, Angela, Coen and Nivedita and my other friends, Edo Dijksterhuis, Maria Koster, Marja Verkerk, Judith de Wolf, Gert Jager and his wife Marja and Bas Harbers.

I appreciate the support of my Kenyan Ph.D and MSc colleagues in the Netherlands. They made the Netherlands home away from home. In particular I am grateful to Mary Omosa, Peter Arama, Peter Okoth, Washington Otieno, Alice Mwangi, Shem Mwasi, Isaac Koskey, Bockline Bebe, Beatrice Salasya and Pius Odunga.

Back in Kenya, I would like to acknowledge Prof. Dr. Omolo Ongati who has given me much support right from my first plans to study abroad way back in 1994. Apart from being my mathematics teacher and mentor, he has always inspired me to work hard in academics. He even offered me his own computer to use during the fieldwork. I am heavily indebted to Mrs Phelgone Eve Omolo,

Principal of Nyawara Girls School, for the arrangements she made that allowed me to combine teaching with fieldwork. I owe a lot to my friend George Omondi and his wife Nancy for the unlimited support they offered me and my visitors from abroad. I thank my family members, my mother, brothers and sisters, whose support and encouragement were limitless.

Finally, I am greatly indebted to my wife Rachael for the support and encouragement she gave me during my data collection and thesis writing. She also volunteered to read some of the drafts of my chapters and made extremely valuable comments including English corrections. I highly appreciate her patience and understanding during my constant absence during the whole period of this study. With honour I dedicate this book to her.



## Preface

This book analyses processes of agricultural development and socio-technical change in western Kenya and in particular Siaya district. In the 16<sup>th</sup> century the ancestors of the Luo arrived in this part of the world from a mythical place called Agoro in Southern Sudan. Their first place of settlement was in Samia, a little west of what is now Siaya district. They later spread out to the savannah woodlands and to the plains along the shores of Lake Victoria establishing fortified villages. They gathered fruits and greens from the forests, hunted wild game in organised groups, planted sorghum and millets in small clearings, practised pastoralism and fishing in Lake Victoria.

By the late 19<sup>th</sup> century, the Luo were still planting sorghum and millet grains, but during the early 20<sup>th</sup> century these were gradually and largely replaced by maize as the major crop. Luo agriculture saw major transformations in the years that followed. Agriculture gradually moved from shifting cultivation to fallow-based agriculture and later to a stage of permanent cultivation. During later periods (roughly from the 1940s) agriculture was transformed due to processes of commercialisation and intensification, while more recently (from the 1970's onwards) it has entered a period of decline marked by the predominance of subsistence production and localised trade. Seeking off-farm income earning opportunities and careers outside agriculture through labour migration became an important trend, as increasing population pressure, reduction in field sizes, and the decline in soil fertility accompanied these agricultural transformations.

I grew up in this landscape without noticing anything particular, nor was I conscious of many changes. People seldom talk about living in a culture unless something out of the ordinary happens. Thus I never took a keen interest in what was going on in my surroundings, unless of course it became a priority to me or was a pressing concern. In 1994, I was admitted to Wageningen University to study for a Masters degree in the Management of Agricultural Knowledge Systems. It was during this time that I was introduced to actor-oriented and systems thinking as useful theoretical approaches for analysing processes of social change. This re-oriented my way of looking at things and I began to see things differently. When I returned home in 1995 - this time as a researcher - I began to discover that the Siaya landscape had been undergoing significant changes. Previously, things that I had taken for granted took on new

significance. My research focused primarily on how farmers internalised induced technology packages in zero-grazing dairy farming where high yielding exotic dairy cows were confined and fed within their stalls. Zero grazing was introduced as part of a bilateral project between the Kenyan and Netherlands governments called the National Dairy Development Project, whose history dates back to 1980s. The data I collected through case studies demonstrated that farmers adopted these packages but only after unpacking them in many ways. In the process, farmers drew on different forms of knowledge (Mango 1996). They contested and even defied the rationale of the scientific knowledge that generated the technology package. Enriching scientific knowledge with local knowledge produced a new form of 'hybrid' knowledge that was very diversified. Some of this knowledge was drawn from the dead. Farmers mixed these various forms of knowledge as they gained more experience with zero-grazing dairy farming.

It was during this time that I observed that the majority of farmers who initially adopted hybrid maize now distanced themselves from it and were 'turning back' to the growing of varieties of local maize. The few farmers who were still planting hybrid maize only did so after redesigning it in many different ways, and I discovered that they have been doing this for some years already.

Another observation was that some of the crops that were associated with poverty and had been neglected by a majority of the farmers were again resurfacing in farmers' fields. Crops such as cassava, sorghum, millet and sweet potatoes were not targeted by research and extension services, which focused instead on spreading hybrid maize as a food and cash crop. But now farmers were increasingly planting these crops again and I noticed how much they valued them. This was an interesting phenomenon for me because when I was growing up, I saw few of these crops in our landscape. An extension officer with the Ministry of Agriculture since 1968 and with whom I have been close to for a long time now tells me that some farmers never completely abandoned the growing of these traditional crops. They grew them but on a very small scale in the vegetable gardens in their compounds.

These processes provoked a number of questions which became part of a Ph.D. research proposal that was developed together with researchers in the Wageningen department of Rural Development Sociology, in 1997. Thus in 1998, I was back again in the same area. This time, I set out on an ethnographic research journey to discover, together with a number of other people from diverse backgrounds, what farming was all about in Luoland. My goal was to collect the detailed data that would allow me to document and explain the observed changes.

# 1

## Research Context and Setting

### Introduction

The starting point of this thesis is that the current directions and dynamics of agricultural development in Western Kenya cannot be understood as a linear process but should rather be interpreted as a '*product of the ongoing interlocking, interplay, distancing and mutual transformation of different actor projects*' (Long and van der Ploeg, 1994: 81). Moreover, observations that farmers in the region are increasingly and actively distancing themselves from state induced technological innovations by engaging in processes that minimise relationships with commodity markets and agro-technical institutions, suggest that contemporary processes of agrarian change are progressively based on distancing rather than interlocking actor projects. I interpret such processes as a form of endogenous development that is strongly embedded in local people's cultural repertoires, in localised institutional arrangements and shaped by prevailing ecological conditions. It is a development trajectory emanating from the farmers' own attempts to generate and control the conditions for development by redefining the predominant social relations of production.

The research journey I set out upon some years ago, aimed to explore the social, cultural, institutional and agro-technical dimensions of how farmers (re-) define and (re-) organise the agricultural landscape in Siaya, Southwest of Kenya. Their pursuit is here understood as distancing actor projects. The context of such actor projects is complex and has a number of historically defined parameters that at best can be summarised in terms of what is referred to in the literature published during the mid 1980's and 1990's on sub-Saharan Africa as an emerging 'agrarian crisis' (cf. Berry, 1984; Lofchie, 1985; World Bank 1981, 1988; 1989; Bindlish and Evenson, 1993; FAO, 1994; AMREF; GoK, 1997, 1999). This so-called agrarian crisis has several dimensions. One concerns the 'local' level, which is marked by endemic poverty, declining soil fertility due to land degradation, failing markets particularly for agricultural inputs (i.e. seeds and fertiliser) and farm gate prices for cash crops such as maize and coffee, lack of alternative employment opportunities, low incomes, increasing food prices, and reduced land holding as a result of population pressure. Cash crops introduced earlier in the Siaya landscape such as coffee, sugarcane, and cotton have so far not proved sustainable and their acreage gradually declined leaving only signs of their previous existence. Some farmers, however, still maintain a few coffee bushes in the hope that there will one day be a market for coffee. Those that grow sugar cane do not earn much due to Asian businessmen

## 2 *Husbanding the Land*

owned jaggeries capitalising on the imperfect market conditions. Many 'households' are currently food buyers rather than sellers. They have relied in the past on the flow of cash from migrants for the purchase of food, though today this rural-urban connection is jeopardised since off farm employment opportunities in urban centres are not easy to find (see also Omosa, 1998).

The agrarian crisis has also clear political, institutional and economic dimensions. Extension services are declining due to natural attrition as well as retrenchments following the implementation of the Structural Adjustment Programme by the World Bank in the early 1990s (GoK, 1989-1993). The situation is now even worse since the World Bank stopped funding the agricultural sector in early 1997. Extension departments have few funds and their officers are virtually grounded. Furthermore, input prices have increased while farm gate prices can hardly keep up with inflation. In such conditions it is difficult to sell an extension message based upon commoditised inputs. Such messages become increasingly irrelevant, even to extension workers. An important part of the economic dimension is the poor state of the country's economy. More jobs disappear than are created, and the government is trimming staff to meet the conditions for a restoration of World Bank and IMF borrowing. In these declining economic conditions and lack of alternative employment, people return home ('migrants no more'; cf. Pottier, 1993) and start farming again. They tend to then grow what are mainly known as poor man's crops such as sorghum, cassava, sweet potatoes and millet, and move away from growing hybrid maize by turning to local varieties of maize. They also experiment with alternative ways of reproducing soil fertility.

The question that now poses itself is how to interpret these processes. Are they to be conceptualised as responses to the agrarian crisis, or are they processes that stand for a development pattern that has and would have emerged over time irrespective of the agrarian crisis? While I struggle with this question, farmers continue to look for alternatives.

The perspective followed here is to map out ethnographically how, in a variety of ways, rural people in Siaya pursue their quest for alternatives, what we might call 'actor projects'. I have chosen to focus my investigation on two important aspects of rural life that constitute the core of their quest: the issue of maize, in particular the breeding and exchange of local maize and maintaining genetic variation, and the problem of soil fertility reproduction. The thrust of this thesis is that such actor projects do not necessarily represent a regressive transformation but, rather, another form of development that is dynamic in the region. Who are the social carriers of such actor projects and what kind of institutional configurations present themselves are important questions in this regard.



## The Setting

Siaya District is part of Nyanza province, in the Southwest of Kenya. Yala Division<sup>1</sup> where the research villages are located lies in the northern part of Siaya (see Map 1). The district is populated by the Luo ethnic group, a Nilotic people who first migrated to this area from Sudan via Uganda in the 1500s (Cohen and Atieno-Odhiambo, 1989: 17).

Siaya District was chosen for my research because it was caught up in some of the government induced development projects, including the hybridisation of maize, zero-grazing dairy farming and soil conservation and fertility measures. It is worth noting that the state, as in the colonial period, prioritises the development of the so-called 'high potential' areas in the country. Siaya district, however, is not such a 'high' potential area, but rather a region with a large proportion of 'low-potential' and some 'medium' potential agricultural land.

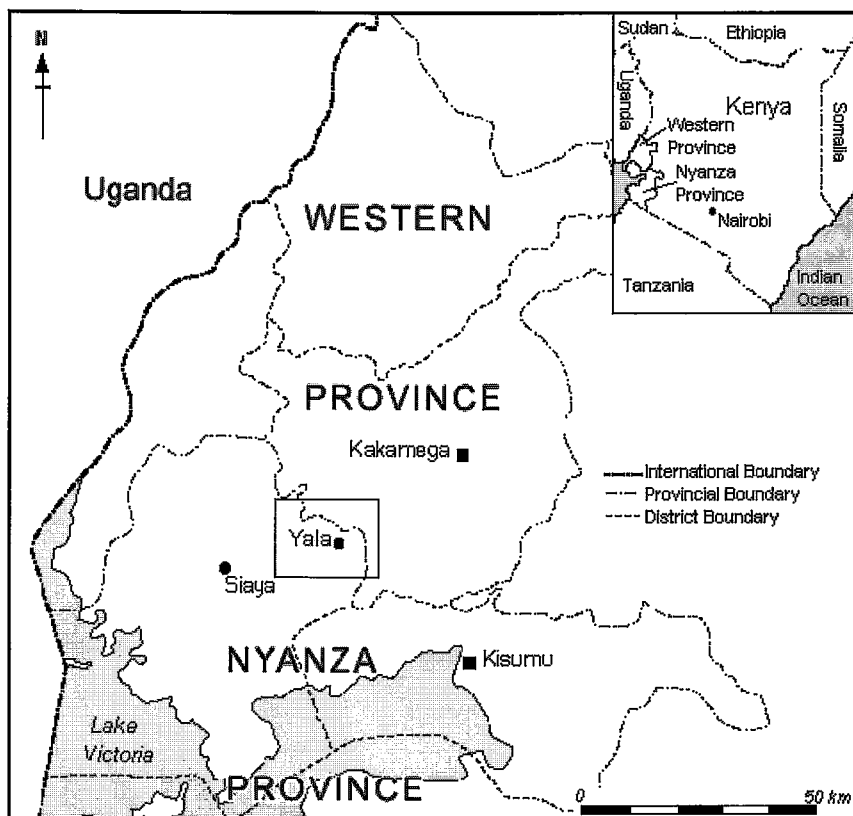
The altitude of Siaya district ranges from 1140m to 1500m above sea level. Yala Division is situated at the higher end of this range. The physical landscape is characterised by undulating and rolling uplands, with slopes varying from 2 to 16%. Towards the south, next to the lakeshore, the land is mainly a peneplain with gentle steep slopes. The fertility of the soils in Siaya district range from moderate to low. Vertisols and ferralsols are the most common soils in the four villages studied. Most soils are underlain by planthite (murram) at shallow depth, resulting in low moisture retention. Yala Division receives an average annual rainfall of between 1800 mm. and 2000 mm. The rainfall has a bimodal pattern with the long rains occurring from March to June and the short rains from September to December (GoK, 1999).

The bi-modal rainfall allows two planting seasons. If indeed there is sufficient rainfall and available labour, the first planting season (*Chiri*) potentially yields a bumper harvest. This is, however, not always the case. The first planting season falls during the long rainy season. Fields and gardens are normally prepared between November and January, while planting takes place between mid February and mid March. The second planting (*Opon*) is immediately after the short rains and starts in mid August. Cassava is one of the crops planted. From mid October quick maturing crops such as sweet potatoes, some local maize varieties and selected varieties of sorghum (*Nyakataye* and *Oyuma*) are sown.

---

<sup>1</sup> The population in Yala Division now stands at approximately 83 500, with densities ranging from 350-600 per square kilometre. Population growth rate stands at 2.8% (Republic of Kenya, 1999).

#### 4 *Husbanding the Land*



**Map 1: Map showing the location of Siaya in Western Kenya**

##### *The research villages*

The empirical data for this book were collected in four villages in the highlands of the North Eastern part of Siaya. The first three villages Muhanda, Muhoho and Nyamnina neighbour one another but show a lot of inter- and intra-village differences (see Map 2 for their location). This differentiation can be explained by factors such as resource endowment, early exposure to 'modern' education and missionary activities, the physical landscape, government projects and the great chief of the region who reigned in the early 20<sup>th</sup> century. The Abaluhya established all the three villages as early as the 16<sup>th</sup> century, but by the late 19<sup>th</sup> century, the Luo had conquered these villages in tribal warfare with their

neighbours, the Abaluhya (Ogot, 1967). The fourth village Luero is situated slightly to the north of these villages, 1 kilometre from Nyamninia village and 2 kilometres from Muhanda and Muhoho villages. It is a 'new' village that was established in the early 20<sup>th</sup> century. It became one of the research villages at a later stage. I 'discovered' Luero when farmers in Nyamninia referred to the research activities going on in that village.

Luero is the site of a pilot project on soil fertility replenishment and recapitalisation implemented by researchers from the International Centre for Research in Agro-forestry (ICRAF), the Kenya Agricultural Research Institute (KARI) and the Kenya Forestry Research Institute (KEFRI) all stationed at Maseno Agroforestry Research Centre. Walking across this village, one sees fields with purple, white, yellow and blue flowers of nitrogen fixing shrubs like the species of *Crotalaria grahamiana* and *Tephrosia vogelii*, species that are being used for trials in rejuvenating soil fertility. Mama Dorcus Kidha, a farmer from Luero village, made the following remark when I met her in her garden.

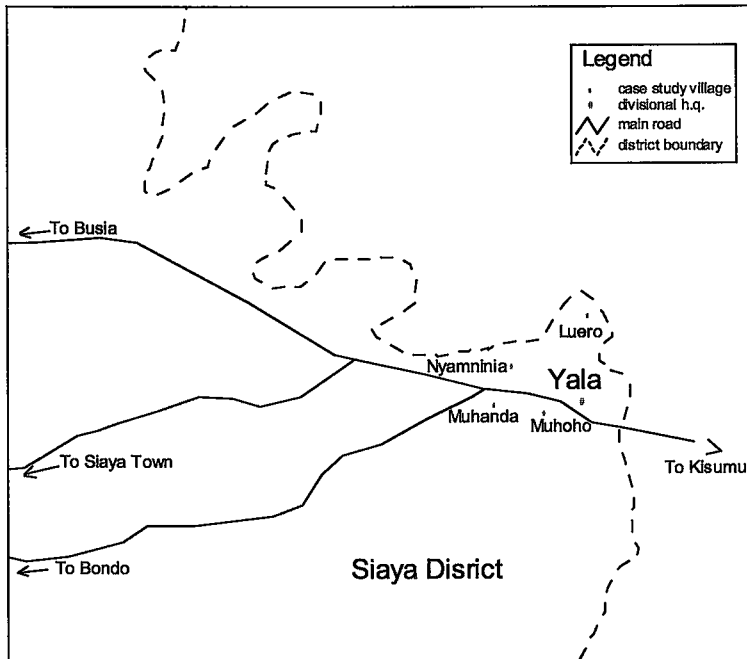
*'Our soils are tired. We do not harvest much from our crops. We lack capital to buy fertilisers. Our plots are also too small so we have to continue cultivating them every season. When I got married in this village there were large tracts of land and we could leave a portion to lie fallow until it regained its fertility'.*

The usual form of Luo settlement is the village, a notion used here for any concentration of rural homesteads. Some villages have clearly visible centres, usually clustered around shops, a school or a church; in other areas where population density is not very high, the homesteads are more dispersed through the landscape. The village has a somewhat limited influence on land use and farming and it is often not easy to see where the land of one village ends and that of another begins. The main task of the government representative in the village or sub-location, the assistant chief, is to maintain law and order and to prevent the brewing of illicit alcohol (*changaa*). The chief relies on the village elders to rule. On the other hand, the village is the place (or social space) to which people feel they belong, and where their closest relatives and friends live. It is also the space for building schools, roads and other amenities, and the political arena where local elders settle disputes.

At the junction of Nyamninia, Muhanda and Muhoho is the market popularly known as Muhanda market. I used to start my research activities in this centre, as every day is a busy market day. There had been a farm-input store at the centre but this had been closed due to poor business. Petty businesses (*duka*) exist in the centre in the form of a bicycle repair shop and two carpentry workshops where coffin making is a booming business. There is a salon where women plait their hair. There is a major tarmac road that passes through, which links Kisumu via Busia border town with Kampala, Uganda. There is a major

## 6 *Husbanding the Land*

bus stop situated in the centre, where at 1.00 p.m. promptly each day, buses from Nairobi arrive on their way to Busia and Kampala, Uganda.



**Map 2: Siaya District and the location of the research villages**

Another booming business in Muhanda market is maize. Traders bring this in from the Rift valley by lorries. Women buy maize from these lorries in 90kg sacks at wholesale prices and sell them in 2 kg tins (*gorogoro*) at retail price. Some of the farmers, like Yiengo Rateng and Oduor Lomo from Muhanda village, also trade maize bought over the border in Uganda at wholesale prices which they ferry to Muhanda market in *matatus* (taxis). Siaya is a maize deficit area, and women sitting with legs outstretched selling maize in 2-kg tins (*gorogoro*) and other food stuffs such as tomatoes, beans, vegetables, fish, mangoes, bananas and oranges is a common sight at Muhanda market. Lydia Lomo, wife to Oduor Lomo, finds the maize market vibrant but points out that it is dominated by private traders who are well informed about periods of relative abundance and of scarcity. But most farmers express an unwillingness to rely on markets for their food and inputs. It may not be mere coincidence

that the local word for acquiring grains from the market -*rundo*- has a common phonological root with words describing mental instability- *rundruok* and *rundore*. Most farmers have a strong feeling that, even if they have money, still they would rather produce food for themselves.

When one walks through these villages, one sees crops such as sorghum, millets, cassava and sweet potatoes, but maize dominates the Siaya landscape. Various varieties of local maize are commonly grown, some having been brought from as far afield as Eastern Uganda. Farmers claim that compared to a few years ago, hybrid maize is hardly planted anymore and is proving to be an unsuitable crop for the region. According to Martin Onanda, Luero village headman, persistent hunger begun in their village in the early 1970s and corresponded with the period when people in these villages started putting more emphasis on growing maize, neglecting sorghum, millets, sweet potatoes and cassava.

*'People used to complain that sorghum was a bit 'heavy'. However during a hunger period, people use sorghum. Sorghum, cassava, sweet potatoes and millets are real security crops. In the mid-1970s, hybrid maize had taken over from most other cereal crops in the region. However now, local maize, sorghum, finger millet and sweet potatoes are preferred'.*

Most farmers in these villages mention decreased crop yields on their farms due to reduced soil fertility. The four villages lie in the highlands of Siaya district whose landscape is characterised by undulating and rolling uplands with steep to gentle slopes. This, combined with factors such as continuous cultivation due to reduced plot sizes, lack of soil conservation structures and intensive cultivation practices, has accelerated soil erosion. The erosion is even more serious in the fields of Oluoch Agulu and Ogwang Madara in Muhoho village, Oywa Yuke and Zedi in Luero village and Erasto Muga and Jacob Odhiambo in Nyamninia village. Fields with the 'beautiful pink flowers' of witchweed (*Striga spp.*), which is an indicator of reduced soil fertility, is a common sight. Sorghum and finger millet can tolerate this weed to some extent and local maize seems less susceptible to the weed than Hybrid maize. Most farmers mention that inorganic fertiliser encourages its growth. Experienced pioneer farmers like Abednego Ochieng and Patrick Wabedha mention that it is not advisable to use fertiliser in fields with very low organic matter.

Some farmers in the region keep dairy animals, although farmers in Nyamninia village tend to be more involved in dairy farming than farmers in the other three villages. They use manure from the cowsheds to try and improve the soil fertility in their fields. Joseph Ogwanjo and Selina Okeyo use a lot of farmyard manure from their zero-grazing units to grow local maize and horticultural crops like tomatoes. Selina argues that with manure from the dairy shed alone, one could get very good yields from local maize.

All four villages have a long history of migration dating from colonial times. Most able-bodied people migrate to town to seek off-farm employment. However, in the last decades of the 20<sup>th</sup> century, employment in urban areas has not been so readily available. This has now become a generational issue since, as some elderly people argue, it hinders farming because many youths are not willing to '*soil their hands*'. Any attempt to put pressure on them to work on the farm drives them to take refuge in town, even when jobs are in scarce supply.

### **Agricultural development and change in Luoland: A theoretical perspective**

This thesis needs to be situated in relation to the ongoing debate about the dynamics of agricultural development. The main task of this part of the chapter, then, is to formulate a theoretical framework that can deal with the complexities of agricultural development and change. I argue here that modernisation and structuralist/neo-Marxist perspectives do not sufficiently explain or capture what I observed in the field. Particularly the problem is the fact that they fall short of adequately grasping the range of farmer strategies that result in both interlocking with *and* distancing from government-sponsored intervention projects that centre on the introduction of new technologies and new organisational and institutional models. These interventions specifically brought technologies for soil conservation and fertility improvement, as well as hybrid maize and zero-grazing dairy farming to boost the production of maize, milk and other crops. These programmes also initiated the formation of a network of institutions (i.e. extension, credit agencies, agricultural research stations and programmes). In the process, the relationships between these and farmers expanded and intensified (van der Ploeg, 1990; Hebinck, 1990).

In order to give details of farmers' practices, a theoretical approach is required that can deal with heterogeneity. Such an approach should be one that recognises that agricultural development – like technology development – does not progress in clear unilinear and straightforward ways. Instead agricultural reality is '*bubbling with change, disorder and processes*' (Drinkwater 1994: 33-34). Many social processes take place at the same time and place, all moving in different directions. As Long and van der Ploeg argue, agricultural development is thus

*'many sided, complex and often contradictory in nature. It involves different sets of social forces originating from international, national and local arenas. The interplay of these forces generates specific forms, directions and rhythms of agricultural change'* (Long and van der Ploeg, 1988: 37).

The different responses I encountered in the field of hybrid maize technology, soil conservation and replenishment technologies, and zero-grazing dairy technology embody different co-existing social processes. These constitute what

Long (2001) and van der Ploeg (1990) call social heterogeneity (see also Booth, 1994), *'a structural feature of agrarian development. [Such heterogeneity] does not emerge casually nor can it be easily engineered'* (Long, 2001: 39).

Modernisation and (neo-) Marxist perspectives, which still inform development agencies in their planning models, not only have severe difficulties in explaining social heterogeneity, but also are normative in their outlook and proposed solutions. Modernisation theory views agriculture in the Third World as generally stagnant, and it presumes that change can only be realised from outside through the transformation of 'traditional' agriculture via the introduction of new technologies and institutional models and configurations. Intervention is thus a central objective in modernisation discourse. As Long and Van der Ploeg put it:

*'modernisation is shaped by sets of external interventions mostly centralised in state agencies aiming to introduce new organisational models for farming, new interlinkages between farming, markets and market agencies, new technological innovations meant to replace existing techniques and knowledge, new forms of socialisation and techno-economic training and, last but not least, new models for the definition of roles and identities for farmers and their wives'* (Long and Van der Ploeg 1994: 2).

Moreover, despite major differences, both (neo-) Marxist and modernisation perspectives share this view of change originating mainly from centres of power in the form of intervention by the state and international bodies (Long 1992: 19). Linked to this is the structuralist assumption that certain socio-economic tendencies function as 'iron laws' (Hebinck and Van der Ploeg 1997: 218) and that therefore processes of commoditisation - the integration of farmers into modern markets, technology and institutions - are inevitable, continuous and desirable. The other side to this argument, of course, is that non-integration will lead to marginalisation.

A core idea that underlies the 'necessity' of external intervention is the conception that scientific knowledge is unitary and systematised (Long 1992: 274-275). 'Modern' knowledge, which is viewed as a coherent whole, is believed to be superior to locally available bodies of knowledge, and it is therefore assumed that farmers will adopt the products of superior 'modern' knowledge when exposed to them. Likewise, it is presumed that agricultural knowledge that has proven its value elsewhere (i.e. in research stations, or in the 'more developed' parts of Europe or the United States) can be simply transferred to other contexts and to farmers that supposedly lack such knowledge. In this way 'peasant communities' are specifically targeted and their local repositories of knowledge discarded or considered inadequate. Intrinsic to intervention programmes then is the belief that one can apply standardised (technological) solutions that prescribe how problems should be tackled. But now there is



mounting evidence that such solutions possess very little mastery of such local, highly diversified situations (see also Hebinck and van der Ploeg, 1997; Long, 2001; van der Ploeg, 1990; 1994; Hobart, 1995; Richards, 1985). Clashes and friction between scientific and local bodies of knowledge frequently result from planned interventions (Long and van der Ploeg, 1989, 1994). In turn, such encounters constitute an important dynamic for the production and reproduction of heterogeneity.

The goals of intervention programmes, however, are not always fully realised, and what emerges are both intended and unintended outcomes. Some farmers interlock their projects with government initiatives, albeit after changing some of the prescriptions of the technology package (Harrison, 1970; Gerhart, 1974, 1976; Hebinck, 1995, 1997; Muma, 1994; Mango 1996). My own study among the Luo of Siaya district shows, for example, that a majority of farmers who begun to cultivate hybrid maize in the 1960s and 1970s, now increasingly distance themselves from hybrids. That is, they have returned to growing local varieties of maize, along with other traditional crops such as sorghum and millet, which had all but disappeared from the landscape.

Structuralist development theories do not adequately capture these processes, as is apparent from their understanding of social reality as '*a stable world of order and progress and scientific certainties*' (Drinkwater, 1994: 33). Development - or rather economic growth - is assumed to be linear and continuous. And any social behaviour that contradicts these assumptions, such as processes of de-commodification, distancing from hybrid maize, or the redesigning packages to stimulate zero-grazing dairy farming, are categorised as 'exceptions' that do not conform to the general laws of development.

Development, of course, is often linked to, or equated with, modernisation; that is, the transformation of so-called 'traditional' societies into 'modern' ones, characterised by advanced technology, material prosperity and political stability (Hobart, 1993: 5). Modernisation theory visualises development in terms of a progressive movement towards technologically and institutionally more complex and integrated forms of 'modern' society (Long 2001: 11). The ideological rationale of modern society is its quest for 'improvement'. Modernisation theories are therefore essentially based on normative ideas and ideals, rather than on systematic empirical findings. An important role within modernisation discourse is given to the notion that science is rational and value-free in the way it represents 'reality'. Agricultural science has been a major impetus for the modernisation of agriculture. In that respect one can even speak of the 'scientification of agriculture' (van der Ploeg, 1994), by which we mean the systematic (re-) organisation of agriculture according to models designed within the realm of the agricultural sciences. That is, it is about how farming ought to be. Basic to these models is a set of widely shared

assumptions, one such being that good farming is highly productive farming. Accordingly, therefore, scientification together with various legal provisions are required to increase production. And related to this assumption is, of course, the belief that good farming is technology-driven and market oriented. This line of argument sees agricultural practices as primarily derivative of the market and new technologies (*ibid.*: 20). Hence, the knowledge of farmers is considered superfluous, traditional and primitive, when it does not fit into scientific models (van der Ploeg, 1990).

The preceding discussion highlights that, in structural development theories, farmers as individuals, and farming households as social collectivities, are principally depicted as passive receivers of superior, 'modern' knowledge. This conclusion runs counter to my own experience with agricultural development processes in Siaya District, which, as I suggested earlier, manifest a diverse set of farming practices based on a mixture of local and scientific forms of knowledge. In order to explain the significance of these processes, it is necessary to make explicit the theoretical parameters of the present research.

At the heart of my theoretical quest is the need for an approach that attributes agency to farmers, that is, with one that recognises the ability of farmers and their household members to shape their own lives, in spite of prevailing structural conditions. The actor-oriented approach fits this profile and is thus used in this study as a guiding perspective. Central to this approach are concepts such as social actor, (strategic) agency, knowledge, interlocking and distancing actor projects, lifeworlds and interfaces.

These notions are elaborated below. I leave for a later stage the linking of actor-oriented analysis with the issue of socio-technical regimes and what is called 'niche' development. Bringing together these two perspectives will enable me to disentangle and interconnect social and technological changes in a meaningful way (see Hebinck, 2001).

#### *An actor-oriented perspective*

Actor-oriented perspectives were already popular in Sociology and Anthropology in the late 1960's and early 1970's. A group of scholars known as the Manchester School established a tradition of ethnography, open-minded fieldwork and social inquiry wherein the social actor was given centre stage. However, many of these perspectives have been criticised for

*'adopting a voluntaristic view of decision-making and transactional strategies which gave insufficient attention to examining how individual choices were shaped by larger frames of meaning and action' and sometimes for 'adopting an extreme form of methodological individualism that sought to explain social behaviour primarily in terms of individual motivations, intentions and interests'* (Long 1992: 21).

Scholars like Giddens (1984), Hindess (1986) and Long (2001) have built upon these early actor-oriented perspectives by attempting to redefine the concept of structure and to rethink about the relationship between actor and structure.

The central concepts of the actor-oriented approach are thus 'agency' and 'social actor'. The concept of social actor is a social construction and not a synonym for the individual (Long 1992: 9). The term can therefore also be used for social entities that can meaningfully be attributed with the quality of agency. The concept of agency is understood here as the capacity of actors 'to process social experience and to devise ways of coping with life, even under the most extreme forms of coercion' (Long 1992: 22). This means that actors are knowledgeable and capable. In other words, they have the means of processing social experience, reaching and formulating decisions and acting upon them (Hindess 1986: 115). In this sense farmers are social actors. As I have stated earlier, the notion of knowledgeable and capable actors, who have the ability to shape their own lives is necessary for comprehension the social diversity encountered in the research area.

To achieve their objectives social actors develop their own projects - 'actors' projects' - understood here as a design or a plan for action to attain particular goals. However these actor projects are normally shaped and reshaped by the local frames of reference or cultural repertoires of the end users. Part and parcel of actor projects are 'social networks', seen here as '*a set of interpersonal and institutional relations linking households and farmers to other key actors*' (Long, 1997: 2). This process of knowledgeable and capable actors interlocking and distancing their projects evolves in the context of the (re-)construction of social networks. This in itself already provides some understanding and explanation of the emergence of social heterogeneity in the region.

### *Interlocking and Distancing*

In this book I try to explain and link the interlocking and distancing of projects with the interplay of varying farming and household objectives and the ways in which farmers identify existing constraints and opportunities for agricultural and rural development. Both the objectives of farmers and their modes of problem identification and resolution, as well as their eagerness to incorporate and redesign new technologies or distance from them, must of course be understood in relation to the diverse settings and choices they may face. The latter include many different dimensions - socio-cultural, political, economic, institutional and agro-ecological (see van der Ploeg, 1990, Long & van der Ploeg 1989, 1994).

As used in this book, 'interlocking' conveys the image of the interlinking of farmers' projects with those of other actors, especially those interest groups and organisations relevant to the field of agricultural development, i.e. traders,

technologists, extension workers, credit institutions, and other farmers. In the process, their projects generally become progressively shaped by the predominant ideology of modernised farming, and their farming practices increasingly affected by the domains of technology and commodity markets and their operative prices. In a more general sense, interlocking is a process of forging particular links between institutions and particular groups of farmers (Long and Van der Ploeg, 1994). 'Distancing', on the other hand, reflects the processes whereby farmers de-link themselves from introduced agricultural innovations and the configuration of institutions that have an interest in the adoption of such innovations. As I show in this thesis, distancing can take many forms, ranging from how farmers redesign existing technologies to how they distance themselves completely from them by rejecting or taking no interest in them. The implications are that farmers look for their own solutions to the particular problems they encounter. 'Redesigning' refers to the processes by which a new idea or innovation is mixed with local insights and practices. Van der Ploeg understands these technological processes as constituting

*'the deconstruction of technical designs whereby particular elements are reconstituted and combined with elements already existing to provide the most methods for 'conversion' and differ sometimes considerably, from the original technical designs' (van der Ploeg, 1994: 9).*

Redesigning is one of the manifestations of farmer responses to dominant (state and donor funded) technological regimes. It is these processes of complying with and redesigning and distancing from agricultural technologies that constitute social heterogeneity.

The view taken here is that farmers do not consist of a homogeneous social category and even within categories, management strategies and styles of farming may differ enormously, which is itself another dimension of heterogeneity. Throughout history a series of differential farming styles have evolved, each with their own logic and rationales, cultural repertoire, and repositories of knowledge. These styles are locally specific and occur within and through localities and can be treated as a specific social space. Such space is composed of the specific way local people define and structure their livelihood, shape the labour process, the localised set of conditions in which the labour process is embedded, and the social mechanisms through which the specificity of the labour process, and therefore agriculture as a whole, is reproduced (van der Ploeg, 1992: 20). Social heterogeneity then underpins my argument that agricultural and rural development is not a unilinear process.

#### *Distancing, knowledge and knowledge networks*

Analytically the distancing of farmers from technological innovations can also be explained in terms of knowledge production, contestation and reproduction.

*'Knowledge is essentially a social construction that results from a particular context and is being reshaped by the encounters and discontinuities that emerge at the points of intersection between actors lifeworlds'* (Long and Villareal, 1993: 160). It emerges out of a complex process involving social, situational, cultural and institutional factors (cf. Rhoades, 1984; Richards, 1985; Warren, 1990). Knowledge examined in this thesis concerns what Hayami and Ruttan (1985) coined as 'induced' technological innovations in agriculture, and what anthropologist label as local knowledge in farmers' practices. I will examine their encounters and interplay. The view taken here is that local knowledge might play a role in solving the problems introduced by the technological interventions of the Green Revolution, because it can contribute to finding knowledge-intensive alternatives to intensive use of external inputs (cf. Richards, 1985; Röling, 1992b; Röling and van der Fliert, 1993).

More often than not, 'induced' innovations emerge from applied science derived from systemic scientific work. After rigorous testing, such (agro) technologies, often presented in the form of a package, are released to the users (i.e. farmers) who are expected to apply the package in the way it is designed. Distancing, redesigning and/or rejection of these technologies are expressions of knowledge encounters, of encounters between different cultural repertoires, in this case the local and the scientific. In their confrontation with externally developed innovations, farmers try welding them to their own local knowledge with a view to fitting them into their daily farming practices. In this way, local and the external stocks of knowledge thus make up farmers' knowledge.

Earlier I referred to knowledge as socially constructed in the interplay between social actors, and between them and their institutional and natural environment. Knowledge is not a solid, static phenomenon; it is being constantly produced and reproduced, shaped and reshaped and yields many types of knowledge, differentiated within and between localities. Furthermore, knowledge is not just objective, e.g. information on the yielding capacity of a certain maize variety. Knowledge also contains social values, i.e. knowledge is prescriptive. Therefore different knowledge types represent certain conceptions and convictions, including how farming should be carried out. Qualifying knowledge as endogenous is problematic since social actors often internalise outside or exogenous elements that fit in and can strengthen existing knowledge, which then function as a frame of reference for interlocking or distancing their projects. This means that in a certain locality external knowledge, (re) produced outside the locality, will be appraised on the basis of knowledge already present.

Knowledge that enters a locality is not simply or straightforwardly internalised but becomes transformed or - as Callon (1992) and Latour (1994) would argue - translated. A model that assumes linear knowledge production (outside a locality), dissemination (to the locality) and utilisation (in the locality)

is misplaced. Both incoming knowledge as well as certain locally existing bodies of knowledge get transformed resulting in a broadening of knowledge. Such a conceptualisation of knowledge delivers a handle for approaching and generating an understanding of different responses to the hybrid maize technology package, zero-grazing dairy farming technology, and soil fertility replenishment technologies.

Distancing involves farmers seeking alternative sources of securing local varieties of maize, which in turn depends on establishing 'new' social networks or revitalising existing ones to find sources of local maize seeds. Also, particularly in the case of redesigning, farmers delink their networks from extension officers and create networks with other actors to generate and exchange the knowledge required to alter technologies. Like Box (1989) and Engel (1991), I see knowledge networks as constituting actors that share and exchange information concerning a specific field of interest or knowledge domain. In this case the knowledge networks are expected to emerge from the social relations in which every individual farmer is embedded (cf. Mitchell, 1969; Boissevian, 1974; Anderson and Carlos, 1976).

Knowledge has components that are logical and mythical and coloured by the social, cultural, political and economic environments that generate them. Therefore the kinds of knowledge 'possessed', and the meanings associated with them, will differ for farmers, technologists and other actors. And the same can be said for the capability or organising capacity and decision making of farmers, technologists and others. In this book, attempts are made to try to identify the various types of knowledge that farmers are actively retrieving in order to address the issues that challenge them. Local and external bodies of knowledge should be viewed as dynamic and evolving through time and space. Here it is not so much the source of knowledge (i.e. whether it is of local or external origin) but rather the dynamic interaction of different fields of knowledge and their relationship to action that is relevant.

This conceptualisation of knowledge has provided me with ways to study and explain the research problem and the diverse responses to induced technological innovations from external intervention.

#### *Power and strategic agency*

The interlocking and distancing of actor's projects, or the (re-) construction of social networks, is an ongoing process. However, one should bear in mind that in the process of network construction not every actor has equal influence. At this point of the discussion, the concepts 'power' and 'strategic agency' are again brought into the limelight. Power in its simplest definition is '*the capacity of an individual to impose his or her will upon others*' (Villarreal, 1992: 256, quoting Weber). According to Latour (1986: 264) '*power is composed here and now by*

*enrolling many actors in a given political and social scheme.* If power can be understood as the ability to enrol others in ones project, then strategic agency stands for the ability to organise those enrolled others in such a way that desired outcomes indeed are (partly) realised. Although power and strategic agency are never distributed or attributed evenly within a society, it is also impossible to find a social actor without them. James Scott (1985) once referred to such attributes as the *'weapons of the weak'*.

In the search for the distribution of power and strategic agency in the (re) construction of social networks in the domain of farming, special attention needs to be paid to the notion of 'social interface', that is, to the *'critical point of intersection between lifeworlds, social fields or levels of social organisation where social discontinuities, based discrepancies in values, interests, knowledge and power, are most likely to be located'* (Long 2001: 243). The lifeworlds to which Long refers are in turn the 'lived in' and 'largely taken-for-granted' social worlds centering on particular individuals (*ibid.*). Long and Villarreal (1994: 44) tell us that social interfaces *'must be analysed as part of the ongoing processes of negotiation, adaptation and transfer of meaning that take place between the specific actors concerned'* and I would argue that apart from revealing the distribution and use of power and strategic agency, the analysis of interfaces can provide us with clues to questions concerning knowledge encounters and whether we can speak of continuities or discontinuities. I will deal with this in more depth in chapters 4 and 9.

The methodological choice made in this thesis is to descend to the local level, or the everyday life of the actors studied. It is at this level that power and strategic agency are employed, where knowledge encounters take place, and social networks (re)-constructed. However, it should be emphasised that interface encounters and negotiations are often influenced by actors not present at the interface. Therefore if one wants to understand fully interface encounters, one has to go beyond the local-level interface (see Chapter 9).

#### *Technology, socio-technical regimes and socio-technical networks*

In this study, high yielding varieties of maize (hybrid maize) zero-grazing dairy farming, soil conservation structures, improved fallows, fertilisers and other soil fertility amendment methods are considered to be technologies. Technology is treated in this study as an entrance point for investigating issues concerning agricultural development in the Siaya District. Before examining and evaluating the usefulness of the notion socio-technical regimes for this study, there is a need to operationalise the term 'technology' since it is a key aspect of the socio-cultural/socio-technical landscape of any society. In anthropology, archaeology, and cultural studies, technology is used to refer to the artefacts or sets of artefacts in a society that are called its material culture (Rip and Kemp,

1998: 334). The notion of landscape can be used to capture this anthropological conception of technology. The socio-technical landscape is a landscape in the literal sense, something around us that we can travel through; and in a metaphorical sense, something that we are part of, that sustains us (cf. Cohen and Atieno-Odhiambo, 1989: 9). This is close to Long's idea of social field:

*'social fields constitute 'open spaces' composed of distributions of heterogeneous elements (material resources, information, technologies, institutional components, discourses and sets of social relationships of various kinds) wherein no single ordering principle prevails. While the pattern of social relationships and the availability and distribution of resources allow for certain organisational possibilities, any order that does emerge within a social field is the result of the struggles, negotiations and accommodations that have taken place between the competing parties. In certain instances, especially in socio-ecological scenarios, the competing parties must also, of course, include animal and plant populations'* (Long, 2001: 241).

Technology has become an important element of the self-image of Western culture. Because it has been, and continues to be, a key factor in transforming societies, it is associated with modernity, progress, and rationality. These associations are carried by the idea of technology in official declarations and in debates, and when technology is used to legitimise particular roles, actions, and policies. Technology has a definite cultural aspect. The motorcar for example stands for a cultural complex, and people understand a reference to the car as not being about a class of actual cars in use but about this cultural complex, and about the problems caused by the motorcar. In this way there is a symbolic element to the motorcar (Rip and Kemp 1998: 336). Similarly we can also talk of hybrid maize and zero-grazing dairy farming technologies as standing for cultural complexes that contain symbolic elements that go beyond the strictly material and biological components.

Other important functions of technology and its symbolic attributions can be recognised. A specific division of labour is predicted on the idea that there is something called technology, separate from organisations and socio-technical landscapes. Thus the idea of technology supports a diffuse social contract linking technologists and other members of society. Technologists are mandated to work on technical progress (and thus achieve progress in general). They have relative autonomy to work on a specific technology so long as they work toward progress and can be seen to be doing so (*ibid.*: 336).

In the same way, public debates about technology are not simply about preferences and needs independent of technologies, but are shot through with assumptions about technology and its possibilities. So the challenge of technology and of orientating and steering socio-technical change is necessarily intimately linked to culturally defined possibilities, into which divisions of labour, cultural codes, and storylines become embedded. To capture these aspects, another concept has been introduced, namely, 'technological regime',



which encompasses rules and cultural framing with existing material culture. It is from this point of view that we can talk about high yielding varieties of maize, high-grade exotic dairy cows and soil fertility replenishment technologies as having symbolic meanings, and their plant breeding, animal breeding and soil fertility technology as constituting production regimes.

The term socio-technical as discussed by AGRINOVIM<sup>2</sup> scholars refers to the 'technology-in-society' perspective (Wiskerke and van der Ploeg, forthcoming: 6). The basic idea is that the diverse innovation processes and technology choices at the local level accumulate in what is called the technological landscape of roads, farms, artefacts, infrastructure, stock and distribution of knowledge and capabilities, production methods, consumption practices, and institutions. Thus, further innovation adoption and adaptation is embedded in a socio-technical landscape. In other words, the 'technology-in-society' perspective takes the multi-level, multi-actor, multi-aspect dynamics of socio-technical change into account, with the focus on the interaction between technology and society, conceptualised as a process of *co-evolution* or *co-production* in which the technology and social context interact and change.

In this study we will make use of Wiskerke's definition of 'technological regime', as used in his AGRINOVIM workbook, as an institutional framework of a technological domain within which ideas are conceived, taken up and further developed to achieve desirable outcomes for the actors concerned (Wiskerke, forthcoming: 17). When we consider all the actors and institutions that are involved in the development of these technologies and their subsequent dissemination to members of the society, then we can talk of socio-technical regimes. The notion socio-technical regime, therefore, refers to the development of a technology in relation to how it is embedded in society. Regimes are complexes of behaviour regulations to which actors are willingly or unwillingly subjected (*ibid.*). Regimes are intermediaries between specific innovations as these are conceived, developed and introduced, and overall socio-technical landscapes (Rip and Kemp, 1998: 338). They are the outcomes of earlier changes and they structure subsequent change (Wiskerke, forthcoming: 17).

Regimes are sustained through network interactions, inter-organisational fields and social worlds. Technological regimes structure the research activities of scientists and other technologists; as such, they are a broader and socially embedded version of technological paradigms. Regimes once established need to be regulated to ensure their survival (see Drummond, 1996: 53, Long 2001: 12 for regimes of accumulation). In his work on regulating sugar production in Barbados, Drummond puts forward the concept of mode of social regulation

---

<sup>2</sup> AGRINOVIM stands for the dynamics of AGRicultural Innovation: studies at the interface of NOVelty creation and socio-technical regIMes.

(1996: 53), consisting of an ensemble of norms, institutions, and patterns of conduct, which constitute the conditions necessary for continued capital accumulation. In regulation theory, a distinctive period of sustained accumulation is referred to as a 'regime of accumulation' (Drummond 1996: 65). This comparison can also be made for the global food regime as discussed by Buttel (1994) in his work on agricultural change. In my case I shall refer to technological regimes based on the production and dissemination of both local and hybrid maize, high yielding dairy cattle and soil fertility improvement technologies and their modes of regulation as prescribed in the technology packages that come with them and by government policies.

The 'technology in society' perspective builds upon a social constructionist interpretation of technology. In short, technology is socially constructed through the ways in which the make up of political society and its power distribution reflect the technological choices that society makes. The breeding of hybrid maize is a paradigmatic case (Hebinck, 2001: 122-123).

The social constructionist view explains that in order to create a relationship whereby farmers rely on breeders, plant breeders and scientists in the USA, a lot of effort was put into so-called hybrid varieties. The early hybrid maize breeders and their contemporaries constructed the seed in such a way that farmers needed to buy fresh seed every year. Hybrid maize could not then be reproduced on the farm and attempts to do so would lead to decline in yields (*ibid.*). If farmers adopt such 'induced' innovation they then become dependent on the seed companies to obtain more seed, which renders the latter a huge market and profits. Furthermore, the hybrid maize package also requires buying fertilisers and adopting a whole series of other technical recommendations on how to plough and plant. The hybrid maize regime is in this way protected. Thus a farmer who adopts the hybrid maize package becomes part of a network of institutional arrangements that provide advice (or extension) to secure the technical aspect of the innovations, and markets for seed, fertiliser, output, capital and machinery (Hebinck, 2001: 124). This institutional environment was once conceptualised by Benvenuti (1982) as a Technical Administrative Task Environment (TATE).<sup>3</sup>

The social vehicle through which technology spreads and finds its way into the society is what I refer to as a socio-technical network. By definition, networks are made up of sets of direct and indirect relationships and exchanges (interpersonal, inter-organisational and socio-technical). They usually transcend

---

<sup>3</sup> This concept was developed by Benvenuti to describe the network of market-agencies and associated institutions to which farmers are tied both economically and technically (agricultural industries, banks, trade consortia, extension services, etc.; van der Ploeg, 1990: 107).

institutional domains and link together a variety of arenas. Networks are characterised by flows, content, span, density and multiplicity (Long 2001: 242).

Socio-technical networks as used in this book refer to formal or informal institutions that are involved in developing technologies and are carriers and disseminators of such technologies. Socio-technical networks are thus defined as a co-ordinated set of heterogeneous actors - for instance, research institutions, companies, donor organisations, government agencies such as extension and credit institutions, and technological end users such as farmers - who participate collectively in the conception, development, production and distribution or dissemination of procedures for producing goods and services, of which some give rise to market transactions (adapted from Callon, 1992: 73). Furthermore, in certain cases, it is possible to anticipate the evolution of these socio-technical networks, since the actors behave predictably, and the technology and its products evolve along lines that are relatively easy to characterise. In other cases, however, the actors composing socio-technical networks have significant degrees of freedom. They develop complicated strategies. There may be a number of innovations, and these can provoke unexpected rearrangements. They may also split into smaller networks or join other socio-technical networks in order to form more or less extensive ones.

Socio-technical networks are composites. They combine human and non-human elements, inscriptions of all sorts, and money in all forms (*ibid.*: 96). According to Callon, their dynamics can be understood through the idea of 'translation', which takes place when intermediaries enrol a number of actors in their 'projects', that is they are able to bring together and translate the various actors' interests and ideas into workable assemblages. The latter are termed *collectiefs* (that is heterogeneous networks of human and nonhuman elements). Furthermore, the translation operation is itself regulated by conventions that are more or less local, and are always revisable. Thus socio-technical networks do not involve human interactions alone where linkages are created with a view of acquiring knowledge about a technology but also exchange of resources about the technology itself, for example, the exchange of seeds plant materials and other resources. This way of looking at technology is referred to as actor-network theory (Latour: 1994). Whether a technology works or not is not an intrinsic property of the technology, but depends on the way it is embedded in a specific socio-technical network (comprising skills, knowledge, patterns of behaviour, organisations and infrastructures).

The interlocking of projects, as used in this book, is seen to be embedded in the effort to modernise agriculture, which aims to redefine and enhance agriculture and to achieve this through intervention projects. Thus, modernisation projects stand for establishing a modern socio-technical regime based on or supported by advances in agricultural science and its applications

(i.e. the scientification of agriculture). It is characterised by a dense network of agrarian institutions as well as often including donor agencies. In this particular case technological change is often assumed to take a linear and straight forward form while in actual fact it is non-linear and a rather iterative process (Wiskerke and Van der Ploeg, forthcoming: 18). In fact socio-technical regimes should be conceptualised as multiple or heterogeneous (Hebinck 2001: 125). According to Hebinck, such a definition is essential for understanding technological change. He argues for two other technological changes. A technological change that emerges 'from within' and one that emerges 'from below' (*ibid*: 125). Open Pollinated Varieties (OPV) of maize breeding for instance is a clear example of change 'from within'. The currently increasing emphasis on OPVs echoes the changes in scenario that have been occurring in technology development since the early days of the Green Revolution, and not only within NGO-type networks, but also within the International Centre for the Improvement of Maize and Wheat (CIMMYT). CIMMYT now progressively allocates core funding to breeding OPVs (*ibid*: 126). This will be clarified later in Chapter 4 with reference to the Kenya Seed Company and other private plant breeding companies. A second example of technological change 'from within', dealt with in detail in Chapter 7, is the case of agro-forestry technologies, which is proposed by some scientists as a second soil fertility improvement paradigm to replace the dominant fertiliser regime (Sanchez, 1999: 3). Improved fallows, involving fast-growing species - usually legumes capable of fixing nitrogen in the soil - are deliberately planted for rapid replenishment of soil fertility.

Technological change 'from below', on the other hand, or 'distancing' as I will call it, represents an alternative to conventional modernisation projects. It is characterised by localised practices, which are embedded in local institutions and local cultural repertoires. Hebinck links technological change 'from below', that is from the perspective of the farmer, his/her spouse, the family, the farm, and/or the field(s), to the notion of 'niche' proposed by Rip and Kemp (1998). The niche may very well be the level where alternative technologies are developed, some of them giving rise to the emergence of new regimes that co-exist with the predominant regime. These niches may challenge the predominant regime (exerting pressure 'from below') which is more static, inert and entrenched. Quoting Geels and Kemp (2000), Hebinck (2001: 126) argues that an important difference between regimes and niches is that different social processes are involved. A regime is characterised by relatively stable networks that manage to reproduce themselves constantly. Within these networks, the direction of technological processes and progress is relatively clear cut and beyond dispute. Niches, on the other hand, are formed by less stable networks in which a variety of experiments are carried out that generate debates and negotiations. In niches, the learning processes are open-ended and less obvious,

progress is made through trial and error, and there is no dominant design. Furthermore, the development of niches depends on willingness to exchange experiences. Later I illustrate this from my own research with recurrent (or mass) selection of local varieties of maize through which farmers have managed to develop their own seed that can out do hybrid maize in many aspects (Chapters 4 and 5). A second illustration is a case where farmers have themselves successfully identified in their own socio-technical landscape a weed, *Tithonia diversifolia* (wild sunflower), as a source of green biomass manure for improving soil fertility (Chapter 7). Such farmer innovations are representative of technological change 'from below' and are hidden novelties that emerge independently in the socio-technical landscape.

Hebinck summarises succinctly the usefulness of the notion of socio-technical regime, providing a dynamic look on processes of (technological) change.

*'First the concept links and connects technology with society; technology evolves in a social context, hence co-evolution or co-production. It thus captures both the technologists and the end-user, and allows for an analysis of their relationships and struggles, and thus encounters between the various bodies of knowledge actors refer to when designing and evaluating technological innovations. Second, it provides insights into how technological change proceeds. Technological change does not follow certain trajectories predetermined by the technologists but can be, and often is, very chaotic, following different trajectories'* (Hebinck, 2001: 126-127).

In earlier publications, Hebinck (1990, 1995) and van der Ploeg (1994) have elaborated on this by emphasising that farmers (always) redesign technological innovations, which in turn gives rise to differentiated patterns of agricultural development such that 'no single ordering principle prevails' (Long, 2001: 241). Second, this 'definitive adieu to structure as explanans' (Long and Van der Ploeg, 1994: 80) is important for an understanding of technological change, its continuities and discontinuities, and the co-existence of socio-technical regimes and niches that sometimes interact and sometimes do not. Third, it builds upon notions such as networks and their builders. Network interactions and institutional configurations sustain and reproduce technological regimes (and niches as well). By definition, networks are made up of sets of direct and indirect relationships and exchanges (interpersonal, inter-organisational and socio-technical). They usually transcend institutional domains and link together a variety of arenas and, as mentioned above, they are characterised by flows, content, span, density and multiplicity. Networks are perceived as fluid, dynamic, and constituted by multiple actors. Hence, the related notion of socio-technical networks is a useful tool for the analysis of the generation and spread of innovations. This also implies that innovations or novelties do not only stem from laboratories and research stations. And lastly, the notion specifically includes the cultural dimensions of technological change and positions culture

analytically as part of a complex set of social relations of production that shape agricultural practices (Hebinck and Van der Ploeg, 1997).

*Cultural repertoires and socio-technical regimes*

Another way of viewing distancing is to look at farming as a social practice embedded in farmers' cultural repertoires. From this point of view the distancing of farmers from certain actor projects needs to be positioned in the interaction between Luo culture and agriculture. Many of the limitations of science stem from the fact that farming is seen as a technical activity instead of a social-technical praxis (within the farm, in the community, between farmer and researcher, between farmers and ecological conditions). Within the agricultural sciences, most solutions are still sought in order to improve existing technologies and methodologies. And thus the existing technological trajectory defines and limits the agenda for research and development.

In order to understand why Luo farmers practice farming the way they do, there is a need to understand how their culture influences farming. The Siaya landscape is not only undergoing transformation physically but also culturally and socially. In this book I explore (in Chapter 3) how kinship relations among the Luo of Western Kenya shape people's social relationships and their access to land and labour. Changes that take place in the Luo social and cultural landscape are closely related to the history of the clan and lineage formation as well as to settlement patterns or 'occupational landscapes'. Agriculture is socially constructed; that is, the way agricultural practice is organised is heavily shaped by the actors involved. The strategies they use, the ways in which they link their practices to markets and to technological developments, the specific interaction between farming activities and regional and supranational policies and interventions, are all decisive elements in the complex process that makes agricultural practice what it is; a highly diversified whole. As van der Ploeg puts it:

*'in particular, the cultural repertoires of the actors involved, their historical experiences (vis-à-vis policy interventions for instance) and the interrelations as created; in a conscious and/or implicit way vis-à-vis local ecology, more often than not play a crucial role' (van der Ploeg, 1994: 1).*

At local level, the community provides the conditions for, and limitations to, farming production. It expresses itself in ideological and cultural organisation, as well as manifesting itself in the economic sphere and in the organisation of power. Individual farmers are members of a given community and their farming activities, both ideologically and culturally, are governed by a specific set of norms. Any external intervention has to be incorporated into these, which partly

explains why farmers redesign and subsequently distance themselves from agricultural technologies introduced by the Ministry of Agriculture.

In this book, I also explore the relationship between culture, markets, technology and agriculture. I argue that agriculture is not only shaped by market forces and technology, but by local culture. Thus the book explores the interfaces between local cultural repertoires and those of scientific research institutions. Empirically, the book highlights what happens when modern externally introduced technologies encounter the innovations and practices of local people. Modern or scientifically based innovations from outside research organisations do not necessarily fit with local practices. A good example in this case is that of hybrid maize (Chapters 4 and 5).

Kinship or, more precisely here, the organising principle of seniority, is intrinsically embedded in Luo cultural repertoires. Practices such as 'first sowing' (*golo kodhi*) and 'first harvesting' (*dwoko cham*) are based on seniority and still important elements that shape agriculture despite commoditisation, labour migration and the increasing influence of churches. Such changes can only be understood with reference to the gradual changes in Luo kinship relations, which I analyse in detail in Chapter 3.

I interpret such elements of cultural repertoires as a configuration that works in the daily practice of farming, since it does not upset the social fabric of rural life in Luo land, despite the fact that such cultural notions are not completely shared. By definition, cultural repertoires characterise the differentiated stock of cultural components that relate to differences in lifestyles, social values and rationale for living (Long, 2001: 242). For my case I narrow down this definition by adopting Wiskerke's definition of cultural repertoire as representing analytically a specific socio-technological regime of a more or less coherent set of rules and conventions that are embedded in local and scientific knowledge, a variety of agricultural practices, and institutions and networks spanning various actors (Wiskerke and Van der Ploeg, forthcoming: 19). This positions culture analytically as part of a complex set of social relations of production that shape agricultural practices (Hebinck & van der Ploeg, 1997). Culture is often presented as a domain that stifles the optimisation of production, a position that one encounters among practitioners as well as in policymaking domains in the so-called Third World. The crucial point advanced in this book is that the currently predominant socio-technical regime of hybrid maize packages, zero-grazing dairy farming and soil fertility conservation and replenishment technologies misunderstands (or misreads) and bypasses culturally embedded notions about agriculture and 'how to farm'. In the end, it is the people themselves that create their own room for manoeuvre (or a niche) by maintaining and reproducing a particular cultural repertoire, even when this is sometimes contested. Most interesting, however, is the fact that local

knowledge repertoires clearly question and contest scientific bodies of knowledge. Claims made by experts (e.g. maize breeders, animal breeders and soil scientists) are immediately counter-claimed by local people in reference to their own agricultural practices, such as mass selection in the case of local maize, the use of stud bulls to serve cows instead of artificial insemination, and the use of locally available weeds to reproduce soil fertility in preference to fertilisers. The debate on productivity and selection procedures clearly signifies this. I argue that creating room for manoeuvre is based on the distancing of actor projects rather than on their interlocking with the predominant socio-technical regime organised by the state and market.

One of the tasks that I undertake in this book is to explain how local culture 'reads' as it were, local as well as scientific knowledge and new technologies (in this case the hybrid maize varieties, exotic dairy cattle, soil fertility replenishment technologies and their accompanying packages), and how culture then forms part of a 'defence line' against practices that are induced and favoured by scientific knowledge.

### **Methodological considerations**

As stated earlier the research problematic is based on understanding agricultural development and change as processes that are based on interlocking and distancing of actor projects. In order to understand these processes, we need to consider certain basic social units of Luo society i.e. at village, farm and household levels. At these levels, I was able to study the behaviour and interrelations between social actors. It is at these levels that actors interlock projects, when for example farming households obtain hybrid maize varieties or new local maize varieties from petty traders. It is at these levels that actors distance projects, when for example farming households decide no longer to buy dairy meal from a stockist since it has become too expensive. It is at these levels that different bodies of knowledge are constructed and reproduced and/or transformed. It is here too that power and strategic agency become realised in the (re) construction of social networks. In other words, it is at these levels that abstract concepts become socially meaningful through behaviour. Therefore it is at these levels of society that answers to the research questions can be found.

My overall approach is exploratory and qualitative. This means that no attempt was made to test formal hypotheses. Although the research methodology included a survey, this was used only for descriptive purposes and not for theory testing. The problem was followed primarily by means of case studies of farmers who have been implementing the induced technology packages in Siaya District. The research approach focused on farmers who practice dairy farming using various methods and farmers who at least in their



farming career have been growing high yielding varieties of maize, developing insights based on the main components of the technical packages. Also Luo classificatory principles related to soil taxonomy and soil fertility management was identified. In doing this with the farmers, they realised that their knowledge was valued and sought after. Farmers' practices were studied by focusing on the objectives, means and constraints that formed the context of the actual practices.

#### *Case studies*

This was the basic methodology used to explore central analytical problems. The characteristics of a case study are: a small number of units of analysis, a labour intensive approach, more depth than broadness, a selective or strategic sample, qualitative methods and data and open observation on location (see also Mitchell, 1983: 133). I found this an appropriate approach when I needed to obtain an in-depth insight into processes that are limited in time and space. Case studies can also be considered a slice of everyday life that can reveal the social dynamics and complexity of ongoing social processes. All data relevant to the cases were gathered and studied by inter-relating a variety of facts to a single case. Cases provided me with an opportunity for the intensive analysis of many specific details. De Vries argues that case studies are constructed through theory. Case studies, therefore, serve to establish the validity of a particular theoretical principle, not by achieving statistical significance but through their ability to elaborate a theoretical principle, by confronting it with the complexity of empirical reality (1992: 68).

Situational analysis then, entails the close-up study of a number of interconnected cases. It was useful for recording in a meticulous way the detailed actions of individuals over periods of time. In the field I sought interconnected cases within a small area involving a limited number of *dramatis personae*. Such cases were later presented in their social context as part of social processes and not as isolated instances (see Van Velsen, 1967: 147). *Dramatis personae* are the actors in the drama whose behaviour and inter-relationships with other actors is of crucial importance. I treated farming households or farmers as cases and use situational analysis to show how their social networks are (re) constructed in the domain of maize cultivation and soil fertility replenishment practices. I found social network analysis to be important because it focuses on how sets of relationships (including those based on genealogies) evolve over time and how different household-state agency relationships interlock (Mitchell, 1969).

As indicated, situational analysis implies the use of qualitative techniques such as participant observation and unstructured interviewing. In depth, interviewing forms a part of ethnography (the art and science of describing a

group or culture, Fetterman 1989: 11), and is useful for understanding the lifeworlds of social actors. Extended case studies and situational analysis are important techniques for providing a close-up view of social interaction and confrontation and they have been used to elucidate how structural forms and processes work themselves out in everyday life situations (see Van Velsen, 1967; Long 1968; Arce et al 1992). Conflicts and everyday routines guide us to particular social actors (such as government officials) and they are linked to other actors.

In this study, I have selected a number of households as cases. Some cases run throughout the book, while others are particular to specific topics discussed. At some point I focus on household strategies and at others on specific individuals of a household and their individual strategies and narratives. I used particular criteria for selecting farming households within the research area. In the domain of hybrid maize, those farming households that had grown hybrid maize at least once in the farmer's lifetime were included. However, one household was also selected that had never grown hybrid maize, since the information provided by this household contributed to an understanding of the practical implications of the principle of first sowing (*golo kodhi*). A second criterion was that the selected households should be as diverse as possible but nevertheless characteristic of the research area. Thus, for instance, I chose households producing for subsistence only, households producing for the market, and households with and households without off-farm income, female headed households and so forth. In the domain of dairy farming, the farmer must have kept high-grade dairy cattle using either a paddocking system or a zero-grazing system where animals are kept in stalls and fed there. For the exploration of soil fertility management practices, I was able to use an ongoing pilot project where the farmers involved were considered 'testers'.

Since interconnected cases were required, some households were approached and selected via snowball sampling, i.e. one household introducing another and so on. In addition, some farming households were selected through government extension workers or NGO's. Introduction to households by extension workers had some advantages. First, this already revealed a small part of the nature of the interface negotiations between farming households and extension workers. Secondly, being in the field with extension workers, allowed one to check their response to processes of distancing from the hybrid maize technology package presented by government. A disadvantage, however, was that farming households might associate the researcher with the extension department worker and might therefore assume the researcher to have a positive attitude towards hybrid maize, which, in turn, could influence their behaviour and statements. To neutralise this bias, I made follow-up visits to the households several times in order to create rapport with them. During the

informal conversations that were part of establishing this bond, impressions of how the farming household organised their social relations in maize production, dairy farming or soil fertility management were recorded. Later on more structured interviews were developed on the basis of those first impressions.

The various techniques already mentioned (see also N. Long, 1989; 250-253 and S.A. Long, 1992: 160-169) for carrying out the case studies were used. My informants were mostly farmers. Moreover the formulation of the problem setting, the choice of research techniques and the interpretation of the data are all affected by our multiple identities and discourses and inevitably the researcher becomes a part of the world he or she is studying. De Vries (1992: 27) in a similar vein argues that establishing a research network happens through a process of mutual enrolment in which the researched become active social agents. This counts for the period in the field as well as for the period after and during writing-up. In other words, both researcher and researched shape the outcome of a study through the many decisions taken during this process. The way I interpreted events, projects and situations was mainly shaped by the information and ideas obtained from actors interviewed or with whom I more informally conversed. Pieter de Vries (1992b) pictures interviews as negotiation processes between actors, where the interviewee as much as the interviewer tries to control the situation and where they jointly construct the outcome of the interview.

### *Ethnographic interviewing*

Most interviews carried out were rather unstructured in the sense that no effort was made to strictly follow a set of prepared questions. Although discussion often began during the first visit to a particular farm with the introduction of questions closely related to the central research themes, respondents were always given the opportunity to take the discussion in directions that interested them. Much of the time was spent reacting to the accounts of respondents rather than getting them to react to the questions prepared. During subsequent visits, issues discussed during previous interviews were often taken as the points of departure. At any given moment, therefore, with different men and women farmers, quite a variety of issues were discussed. During these ongoing discussions, when respondents tried to explain something, when they expressed theories and ideas, when they described their own situational strategies and decisions, their descriptions often contained explicit or implicit comparisons. One could even push the argument further and argue that, in general, when trying to express, to communicate parts of their knowledge, ideas, theories, values, norms or objectives, or when trying to explain particular phenomena, actors could only do so by explicitly or implicitly comparing and

contrasting certain elements pertaining to their personal lifeworlds with those of persons and situations which formed part of their social and cognitive worlds.

Government extension officers, NGO workers and researchers of the Kenya Agricultural Research Institute (KARI), Kenya Forestry Research Institute (KEFRI) and International Centre for Research in Agro-Forestry (ICRAF) were often interviewed in an unstructured manner in the field or in their offices. Since one regularly came across them, it was easy to bring up points for discussion as they emerged.

In addition to in-depth interviews with selected informants, I organised group discussions. As the study dealt with the networks of those involved in local ways of organising, such discussions gave me the opportunity to grasp the operations and day-to-day practices involved in local institutions and groups. This interviewing technique allowed me to look at the ideas and interactions over a wide range of people and their reactions to one another's points of view.

#### *The study of genealogies, critical events and life histories*

In order to understand how people relate to one another in the village, I studied the genealogies of families and how land was distributed among family members. Kinship relations seemed very important but at times confusing. Everybody seemed to be related to everybody else in different ways. The genealogies helped to disentangle these webs of kinship relations and estimate the role they played in social life and politics. Secondly, with respect to land inheritance and allocation, I wanted to find out how this worked in practice and what had happened to the land over the years. Again by studying the genealogies of village members and their fields, I was able to understand the main causes of land conflict that I encountered. From the beginning I had known that I would encounter conflicts and tensions in the research villages, particularly when it came to studying rights to land. Conflict situations gave me insight into the central resources at stake, and into the power struggles and practices that developed around them. More particularly critical event analysis allowed me a better understanding of kinship structures.

Combining genealogies with life histories provided an additional methodological advantage in that they proved to be excellent ways to get at the past and learning about people who appeared in the genealogy but were absent or not mentioned in the village. Although these genealogies were very labour intensive, they gave invaluable insights into the movement of people, into kinship relations more generally and into land histories. I found life histories to be a flexible research tool that also encouraged many informants to open up and agree to further interviews. By using life histories, I focused on critical life experiences (see also Plummer, 1983 and Webner 1991).

Oral histories appeared more concerned with tales of origin, trade and battles than with the duller subject of agriculture and were, moreover, mostly told as freely narrated stories, wherein the past and present were mixed, as were also facts and views. Historical processes were not only remembered but some left traces in the field. For example, the landmarks of the ancient fortified villages cutting across maize and cassava fields can still be found in Nyamninia, Muhanda, and Muhoho villages.

#### *The survey*

Surveys were conducted using a semi-structured questionnaire to supplement the case studies. In this way, several new issues and research themes, local classifications and concepts could be integrated into the questionnaire. Whenever a survey was conducted, a simple random sampling technique was used for selecting farmers for interviewing. This was aimed at minimising the biases that might come from the generalisation of results from the case studies.

#### *Secondary data collection*

Secondary sources for this study come from an extensive and diverse literature written by missionaries, explorers, colonial officers, foreign researchers, civil servants and newspaper reporters. Several of the authors were involved as actors or otherwise interested in the situations or events they described. Some would have views clouded or sharpened by their education or professional prejudices. Some use was made of the wealth of 20<sup>th</sup> century materials in the Kenya National Archives, Nairobi. Most of the information studied there dealt with the occurrence of food shortages and the related attempts of the colonial governments to affect changes in the cropping patterns of the Luo.

#### *Level and unit for research*

The research was conducted at the local level as initially proposed. The unit of analysis was the farm (the farm here includes the field and the household). A holistic picture of acquiring knowledge for interlocking, redesigning and subsequent distancing was developed by focusing on relationships between household members within and beyond the farm. Community relationships were also taken into account. The term household in the Luo context and as used in this book is close to den Ouden's definition.

*'households' are the small residential groups in which people live together for the purpose of defence, offence, production, consumption, the care of children and others who cannot look after themselves properly, and for the socialisation/enculturation of children'* (den Ouden; 1981: 6).

The usual form of Luo settlement is the village, a word used here for any concentration of rural homesteads

### Organisation of the book

This book is organised into three parts. Part One deals with the Siaya landscape and its transformation. The next chapter (Chapter 2) begins with an analysis of the patterns of agrarian change in Nyanza province, Western Kenya from the beginning of the 20<sup>th</sup> century. It is an account of the land, people and institutions. A major part is devoted to an historical analysis of the process of agrarian change and the dissemination of new farming methods in Siaya District in particular. It examines Luo farming practices and how they evolved over time and changes in the landscape and the cropping systems. Chapter Three analyses how farming is embedded in and shaped by Luo cultural repertoires. It explores how kinship relations among the Luo of Western Kenya shape people's relationships and notions of land and labour and technology. The changes that have taken place in the Luo social and cultural landscape are closely related to the history of the clan (*dho-ot*, *libamba*, *oganda*) and lineage formation (matrilineal with matrifocal units and friendship relations) as well as to settlement patterns or the 'occupational landscape' (e.g. the gradual transformation from *gundni bur* to *gweng* in the wake of British expansion) and residential patterns (from *gweng* to *dala*). In addition, issues related to land acquisition (field allocation, inheritance and distribution) and the organisation of the agricultural labour process (from labour groups such as the *Saga* to family and sometimes wage labour) are intrinsically embedded in Luo customs.

Part Two is about the encounters between local and high yielding (hybrid) varieties of maize. It begins in chapter Four with the history of maize in Luoland with an emphasis on the socio-technical networks through which the different maize varieties spread in Luoland. I then analyse the different breeding and selection regimes through which maize is bred and propagated in detail. Both represent specific technological regimes, each with its own characteristics, social relationships and dynamics. But before I embark on a comparative analysis of these regimes, there is a need to elaborate the way hybrid maize spread in Luoland and the Siaya region. Contrary to the spread of local maize varieties, the proliferation of hybrid maize after the mid-1960's involved the establishment of a particular technological regime - or a planned intervention - designed to radically transform maize farming. The way hybrid maize spread stands in stark contrast to the way that local maize spread, and it differs substantially from the way the earlier interventions of the colonial state based on trial and error were directed towards the improvement of local conditions. While maize varieties originating from such early state interventions still feature today, the hybrid maize regime never completely managed to fulfil its mission in the region. After this analysis I zoom in on the

differences between 'local' and hybrid varieties of maize, underlining their contrasting characteristics. The chapter ends with an analysis of why people prefer local maize to hybrids. Chapter Five elaborates on the contemporary patterns of maize production. One clear trend that has emerged over the years is that the hybrid maize package has mostly not been adopted in the way that research and extension prescribed and envisaged it. In other words, the package is (or was) redesigned by Luo farmers to fit their own particular conditions. In this chapter the analysis of the narratives of farmers and extensionists in the region show how and why this is taking place. A second major trend is that many farmers have stopped planting hybrid maize altogether and have reverted to local maize varieties only. The last part of the chapter is devoted to an analysis of why hybrid maize is slowly and gradually disappearing from the Luo landscape. In the introductory chapter I have coined the notion of 'distancing' to analytically tackle this phenomenon.

Part Three, beginning with chapter Six, covers the domain of soil fertility. The chapter dwells on two areas of concern. The first is a review of soil fertility related policies and interventions over the years. The colonial state implemented, notably since the Swynnerton Plan and even before (see Chapter 2) various policies to deal with the problems associated with soil erosion. The chapter maps out in detail what these policies were about and in particular how the Luo responded to such measures. A description and discussion is then presented on local knowledge in the production and reproduction of soil fertility. With reference to farmers' narratives one can also identify some of the constraints of the strategies that they devise. Chapter Seven deals with how a government and donor-designed project became redesigned by Luo farmers. While the Kenya Government and international donor, the Dutch Government, designed and implemented the National Dairy Development Project (NDDP) with the view to increasing the production of milk for the market, Luo farmers 'unpacked' it so that the project fitted their own priority; the reproduction of soil fertility. This phenomenon may explain why the Luo, like other ethnic groups in Kenya, were generally very keen on the project. This chapter, then, describes how a development project produced a series of intended, but at the same time a number of unintended and unforeseen outcomes. Chapter Eight discusses a very recent project aimed at enhancing agricultural development in Luoland through soil fertility replenishment. The project called Soil Fertility Replenishment and Recapitalisation Project (SFRRP) was developed by the International Centre for Research in Agro-forestry (ICRAF) which is part of the international Consultative Group on International Agricultural Research (CGIAR) together with the Kenya Forestry Research Institute (KEFRI) and the Kenya Agricultural Research Institute (KARI). The project is being

implemented together with the Extension Department of the Ministry of Agriculture, non-governmental organisations (NGOs) and private sector organisations. The aim of the chapter is to follow this project from its inception to implementation with a view to answering the claim of whether agro-forestry technologies indeed represents or stands for the second soil fertility paradigm.

The last chapter of the thesis pulls together the theoretical threads of the thesis and summarises the main findings of the study.





## Agrarian Development and Change in Luoland

### Introduction

This chapter gives an overview of agricultural and rural development in the region where the Luo have settled over the years. Specific attention is given to changes over time with respect to farming and livelihoods. Thus the chapter is a historical contextualisation of current farming practices. I focus largely on the period shortly after the beginning of the *Pax Britannica* in the late 19<sup>th</sup> century and specifically with how the British colonial administration attempted to mould processes of change in the region to fit its own interests, and responded to critical events such as famine. The chapter also compares developments in Luoland with processes of change in the rest of the colony. This will necessarily be general as most of the colonial data available is aggregated at provincial level. Luo territory was first administered by the British as part of the Eastern Province of the Uganda Protectorate (established in 1895). Luoland became part of Kenya in 1902 in what was then called Nyanza Province. Siaya region, where the research villages are situated, was in the early days of colonialism part of Central Nyanza District. After Independence in 1963, the area was subdivided and Siaya became a district of its own in 1967.

I will not attempt in this chapter to compose a full historical analysis of pre- and colonial Kenya and Luoland, nor to analyse in detail political and economic developments and the driving forces of history. This has been done before by Fearn (1961), Ogot (1967), Hay (1972), Heyer (1975), Kitching, (1980), Cohen and Atieno Odhiambo (1989) and Hebinck (1990). What is essential though is to periodise the history of colonial Kenya, and this will be done in summary form based on the earlier mentioned analyses. The literature suggests three major periods can be distinguished in Kenya's history. The so-called pre-colonial period featured focuses here specifically on changes at the level of agriculture. I then focus on the colonial, and then on the post independence period. In order to illuminate clearly the changes that took place during these three major periods, I discuss the major events of these relevant sub-periods in the context of a longer historical period.

The second part of the colonial period covers the years following the Great Depression, that is the period leading up to World War II, and to political independence in 1963. This period marks a significantly different phase in Kenya's history. One of the consequences of the years of the Great Depression was that the settler economy came into a serious state of crisis and bankruptcy.

The settlers demanded colonial state protection and enormous subsidies for their agricultural enterprises. At more or less the same time, certain sections of the colonial administration began to discover the comparative advantages of African commodity production. This coincided with political changes in Great Britain with the effect that colonies were to be reorganised in such a way as to become financially independent. When the demand for food to feed the military campaigns during World War II increased substantially, the attitude of the colonial administration towards African commodity production changed dramatically. The balance of political power gradually shifted away from the settlers to give more political weight to those sections of the colonial administration that aimed to support African agriculture. The publication and subsequent implementation of the Swynnerton Plan in 1954 signalled the demise of settler interest – though as many authors would argue policy changes were already in practice in the years preceding the Swynnerton. Policies that discriminated against African commodity production were lifted and a start was made with the privatisation of land. Consequently, commodity production expanded enormously and the participation of African producers in the market economy almost exploded. Such changes cannot, however, only be placed at the level of colonial politics, but were also a response of the colonial state to the growing sentiments of certain sections of Kenya's African people for political and economic self-determination, for participation in commodity production and private land tenure.

### **The Pre-colonial Period**

The history of the Luo people in Kenya in general and the Luo of Siaya District in particular, begins outside Kenya, probably in Sudan from where they are said to have migrated. The aim of this section is to give a brief outline of the origin of the Luo speaking community and their settling in Kenya.

There is a general consensus among scholars that the Luo-speaking people of Kenya came into the country before the 16th century from Sudan (Ogot, 1963, 1967, Ochieng, 1974, Crazzolara, 1954). Crazzolara states more specifically that they were part of the Ramogi, the largest group of people in Acholiland, and their original home was at the foot of the Agoro range in the Sudan (Crazzolara, 1954: 333). The Luo reached what is now Siaya between 1490 and 1600 (Ogot, 1967: 152). They first arrived at Ramogi Hill in Siaya from Uganda (Cohen and Atieno Odhiambo, 1989: 38). Their earliest settlement was in what is today Alego in central Siaya District. A second wave of migration in the 1600s brought Luo settlements to Southwestern Siaya. Luo migration to South Nyanza began in the mid-1700s, and continued through the next century. Their preferred areas for settlement were grassland and savannah woodland. From the mid-1700s onwards the Luo gradually conquered and occupied the whole of Siaya until

the *Pax Britannica*, at the end of the 19<sup>th</sup> century, prevented them from moving any further. It should be stressed that the gradual conquest of Siaya was not planned and carried out by the Luo tribe as a whole. More often than not different Luo groups were competing. Having moved into land already claimed by surrounding tribes, the Luos early settlements were large fortified compounds built for defence. When the Luo arrived in Siaya, they adopted a sedentary form of life pursuing various modes of survival. They kept livestock; they fished in Lake Victoria and nearby rivers such as Nzoia; they hunted wild game for food; they cultivated such crops as millet and sorghum. They also engaged in trade with the people of Uganda across Lake Victoria and the Abaluhya, especially the Samia who provided them with iron implements before the emergence of independent Luo blacksmiths. Other commodities traded on with the Abaluhya during these periods included grains in exchange for livestock (Ochieng and Maxon, 1992: 40).

The Luo practised shifting agriculture that by then was largely oriented to the subsistence production of finger millet, sorghum, the field pea and melons. Cultivators would broadcast seeds and use wooden hoes known as *rahaya* for light seedbed preparation. The use of manure was hardly known. More permanent settlement instigated a gradual transition from shifting cultivation to fallow-based agriculture. Staple foods were still millet, finger millet, sorghum and sesame. Luo farmers that moved to higher-rainfall areas adopted the cropping practices of the neighbouring Bantu tribes, and started growing new crops such as bananas, maize and sweet potatoes. New fish-drying methods developed and stimulated the exchange of fish for millet at inland markets.

## **The Colonisation of Luoland**

### *The period 1895-1930*

British colonisation of Kenya and Uganda brought a final halt to territorial expansion by 1895. This was also the beginning of the end of ethnic warfare among various ethnic groups in Kenya. People were now supposed to settle where they were. Further settlements in open land were done in a peaceful manner. With the introduction of colonial rule, chieftainship replaced tribal organisations. When the British arrived in Luoland they were confronted with a society whose people were growing crops that represented scarcely any market value for the rest of the colony nor for the British economy. Hence the area was of little value to them save as a labour reservoir. It did not really matter whether the area was initially part of the Uganda Protectorate or not. It was only ceded to the Kenya Colony when it had been established that Kenya had its own unique role to play as a colonial state (Ochieng, 1974: 74). It is important

to mention here that, contrary to the colonial image of areas like Luoland, the Luo were actively integrated in a regional market economy before the British arrived. The Luo, as earlier stated, were exchanging surpluses with neighbouring ethnic groups such as the Abaluyha, the Maasai, Kalenjin and the Gusii for commodities not produced by them or for which they experienced shortages.

The transition to permanent agriculture began during the early colonial period when increased demand for both cash and subsistence products to meet local needs created new pressures for intensification. The colonial administration tried to effectuate changes from the beginning and attempted to encourage the growth of 'economic' crops by Africans. The administration's efforts in the field of agriculture were haphazard and hardly based on an intimate knowledge of the possibilities. Almost everything was tried. This was in stark contrast to what happened in the field of levying and collecting head and hut taxes, and also missionary activities.

Crops that were introduced included industrial crops such as sesame (introduced in central and South Nyanza in the period 1908-10) improved varieties of food crops such as maize, beans and peas, and crops with both industrial and domestic uses such as groundnuts and wattle. Thus, to take one of many examples, a quarterly report for 1909 noted that *'groundnuts, sesame and maize, and small quantities of rose coco and white beans were issued over the year, and the results up to date show promise'* (Kisumu Annual Report 1909: 10). It also noted however that cottonseeds had been issued 'from time to time', but the result up to 1910 was disappointingly low. This was because of unsuitability of most of Nyanza's soil and rainfall conditions for cotton (Hay, 1972: 72-78). Similar issues were made in the following year, and by then the District Officer was saying *'the new economic crops are now mainly producing the hut tax'*, and instanced the decline in stock sales at the tax collection period as proof (Kitching, 1980: 25). Whether he was justified in such optimistic assertions or not, the remark clearly goes to the root of the initial motivation for the introduction of new crops - which was simply to generate a cash income for the African from which he might pay 'his' tax. Apart from the broader objective of making the new colony self-supporting, and in particular justifying the enormous expenditure on the construction of the Kenya-Uganda railway, such a policy was also thought to have local advantages in ending the practice of paying taxes in livestock, of which the Administration then had to dispose.

Up to 1918, and indeed, according to Fearn (1961: 63-90), up to 1931, the results of these administrative efforts in Nyanza Province were minimal. The failures were due, as Hay (1972: 129-134) shows, to the low returns available on some of the crops chosen (above all cotton) because of inadequate knowledge of the soil and rainfall conditions in the area, and to the methods used for first

introducing crops. This nearly always involved a degree of coercion on the part of chiefs and headmen.

Between 1894 and 1900, Hobley, a household name in Western Kenya signifying the violent nature of British military pacification expeditions, was the British officer accredited with bringing the Luo under effective British control. He was the one who in 1900, introduced the hut tax and, later, the head tax as a means of mobilising them for the colonial state (Bookman, 1973: 42). Because the Luo had no money to pay taxes, the able bodied men of 16 years and older were forced, where persuasion failed, to leave their homes for urban centres and labour camps on white farms to earn money to pay for their taxes. Those who defaulted in tax payment were forced to provide free labour on public works such as roads. When World War I broke out in 1914, the British needed not only able-bodied men to work in the carrier corps, but also food to feed the soldiers and the carriers. Such able-bodied men were therefore conscripted by force and livestock were seized for use as food.

During World War I large numbers of Luos were recruited both for the Carrier Corps and on settler farms. By 1916 the methods of recruitment were so brutal that 'many natives living in proximity to the Uganda Protectorate crossed the boundary to reside in Uganda territory (KNA, 1916). In April of the same year there was an increase in hut tax (*ibid.*). To feed the soldiers in the war, peasants were coaxed, or bullied, to sell their food surpluses to the government, and 'a lot of oxen were bought out of native reserves for military transport and food (*ibid.*). Meanwhile labour recruitment continued (See Table 2.1.)

**Table 2.1: Labour recruitment in Nyanza between 1914 and 1917.**

Year	Carrier Corps	Other Labour
1914 - 1915	18,169	26,245
1915 - 1916	24,184	17,138
1916 - 1917	21,900	18,577

Source: KNA (1917)

With so many young men living outside Nyanza Province, and an increasing number of young people now attending school, rural agricultural labour was depleted. Only women and old men remained in the villages. The food situation in the rural areas now needed only a little disturbance to turn it into a calamity. In early 1918, some 27,784 more carriers were recruited from Nyanza for the military, and a further 19,544 'voluntary labourers' were recruited for Government Departments and private employers. The Nyanza Provincial Commissioner, C.R.W. Lane was forced to admit in his 1917-1918 annual report

that agricultural efforts during the year were greatly hampered by the withdrawal of large numbers of men for the Carrier Corps (KNA, 1918).<sup>1</sup>

Before the 1930s, migrants were largely unmarried males or they were squatters, who tended to migrate as whole households. Young men played a minor role in agriculture. Their main responsibilities had been cattle keeping, hunting and warfare. The advent of colonial rule made their warrior role obsolete, while game stocks fell with rising population density. Boys took over the herding responsibilities of young men, who left to work as migrants.

The end of the war introduced for all males 16 years or over an obligatory identification system, *Kipande*, with its inherent denigration. *Kipande* was a labour record card showing periods of employment and unemployment that was introduced after enacting the Native Registration Ordinance, which aimed at controlling the absolute supply of labour (Hebinck 1990: 47). In this way, the government could keep account of the size of the labour force and calculate estimates of head tax (Bookman, 1973: 43). In these changes the chief was quite instrumental, a phenomenon that caused him both honour and embarrassment at the same time.

To the colonial officers the African chief was one of the natives who, because he knew his fellow tribesmen on a personal level, stood for efficiency in translating colonial policy and in ensuring that it was acted upon as expected. The colonial administration rewarded him with a regular salary that gave him a high standard of living, free education for his children, and power. In Luoland, some of the chiefs were only too happy to use the name of the colonial administration to enrich themselves by carving out large tracts of land unquestioned by their clansmen and to use their added wealth to marry as many wives as possible. This was consistent with the traditional expectation that a leader must have a large family and wealth.

Cotton seems to have remained unpopular over many years in Nyanza on land that could support alternative food/cash crops like maize or beans. The Luo resisted cotton because it coincided with the major season of growing food crops in Luoland, which falls in March to June. In addition, farmers' felt that cotton had only one exchange value and was of no use value at all: it was not even edible. It followed then that cotton was only likely to succeed in locations unsuitable for the growing of any heavier-yielding food/cash crop (because of

---

<sup>1</sup> Indeed around this period, the *Keya* famine struck Luo land. It started in 1917 and extended to 1919. *Keya* was coined from the abbreviation KAR (King's African Rifle). Because it was a protracted famine, the Luo later gave it the name *Chwe Kode*. The Luo responded to this famine by planting security crops that are drought resistant like sweet potatoes and cassava that they imported from Uganda. The colonial administration on their part responded to the famine by issuing a considerable amount of maize seed to the people.

aridity). Such conditions prevailed in the lakeshore locations of central and southern Nyanza.

Nonetheless, some of these efforts were not entirely without success. Hay (1972: 134) argues that in trying 'everything', colonial officers did hit upon some crops that were suited to local conditions, could be integrated into the labour requirements of domestic production, and were sufficiently remunerative to be attractive. As a result, crops that may have obtained a negative or minimal response under administrative pressure, were very often taken up again by local innovators in the 1920s, and spread much more rapidly thereafter. In terms of both volume and value, there is no doubt that the most significant of these crops was the European white maize, which effectively displaced local millets as the indigenous staple, and provided the main African cash crop with the potential of surplus production for exchange.

The initial general expansion of cultivated area in the period 1909 to 1918 in Nyanza owed something to improvements in the cultivating technology available. Thus Hay notes that while a wooden form of hoe was still in use in Kowe in 1900, by the 'early 1900s' a hoe with an iron blade (called *Nyarite* or *kasiri*) had been introduced, and by 1918 somewhat stronger iron-blade machetes (known as *Opanga*) were obtained from Indian traders. She notes however, that the 'modern' form of English hoe (or *Jembe*) did not appear in Kowe until the 1920's (Hay, 1972: 149). The vast majority of people used the wooden hoe, or *rahaya*, as their prime agricultural tool in the 1890s, but even then a few men were experimenting with new types of implements which would ultimately increase agricultural productivity. *Nyar Yimbo* was a hoe with a blade made of burnt clay with a high iron content; it was prestigious but very expensive (it cost a cow or more in the days when cattle were scarce), and it proved to be impractical, as the blade broke easily. Only wealthy men bought *Nyar Yimbo*, and it remained a luxury item. It may be that in areas of Central Nyanza nearer to Kisumu the process was more advanced by 1918, at least among chiefs and headmen and the few educated elite. For example, the Kisumu district report for 1913-14 notes that '30,000 English hoes' were sold in Kisumu, and that 'hoes and slashers' were among the record quantities of imported goods purchased by Africans (Kisumu Annual Report 1913: 15).

The expansion of the area cultivated was principally devoted to food crops. The Luos preferred food crops above market crops as these yielded surpluses that could provide both food for the family and could be exchanged for cash or, more common for this period, bartered. By concentrating on food crops women cultivators were able to raise their standards of domestic consumption, make attempts to increase food security for their dependants in the event of natural disaster, and create an increased stock of 'exchange values' with which other products might be obtained. This of course partly explains the initial and



continuing unpopularity of cotton, because apart from other problems (which it introduced), it was a 'pure' cash crop, and thus commitment of land and labour power to it did not carry the element of built-in security inherent in the production of increased food crop surpluses. The most powerful initial stimulants to the expansion of production were likely to have been the desire to obtain tax revenue without recourse to the sale of livestock, plus the desire to obtain increased 'exchange' access to livestock through the production of greater surpluses (Kisumu Annual Report, 1907: 1 and 1908: 3).

By 1923, rapid expansion of the cultivated area was under way in Nyanza Province as a whole, in response to the price recovery of 1921-2. An initial good producer price for cotton of 25-30 cents per pound stimulated the planting of some 5,000 acres in the Uyoma, Asembo, Seme, Samia and Ugenya locations of Central Nyanza district. In Western Province a similar amount of planting occurred in the Western locations near the Ugandan border (Kisumu Annual Report, 1923: 16).

By 1924 the planting and production of finger millet, maize, sesame, sorghum, beans, groundnuts, and onions in Central Nyanza had also expanded. Despite hail damage the district exported 4,000 tons of maize and 600 tons of groundnuts. In the same season, South Nyanza exported 1,282 tons of sesame seed, and 603 tons of groundnuts, no figures being provided for maize or beans, which at this period seem to have a smaller part of the district's exports than either of the former (Kitching, 1980: 41).

At this point in the two districts we enter a period of steady expansion during which District Officers apparently lost interest. Estimates of food crop exports and production disappear from the reports, to be replaced by an almost exclusive concern with the problems of cotton. However, the Administration's attempt to promote cotton production in Nyanza Province did not reach full momentum until the 1930s, when it became one of many policies designed to raise the colony's foreign-exchange earnings during the depression.

It is clear then that, despite administrative indifference, a sustained expansion of food crop surplus and export continued until 1930 throughout Luoland, with a boom in prices for maize, beans and sesame during late 1928 and 1929 as a result of the drought in a large area of central Kenya, from the Rift Valley to Ukamba, and even parts of Coast Province. Before this, in 1927, the upland areas of South Nyanza (Kisii) and Western Province had once again been able to benefit from drought in the Lake Shore areas, and the familiar exchange of livestock for grain (which clearly had a long pre-colonial history) occurred once more, much to the advantage of the grain cultivators (Kisumu Annual Report 1929: 13).

During this period, while the colonial administration was carrying out its pacification programme, the missionaries were carrying out their 'civilising'

missions in western Kenya with direct impact on Luoland. For example, at the beginning of the 20th century, the Church Missionary Society was established at Maseno and Ngiya in Siaya district; the Church of God Mission at Kima in the neighbouring Bunyore location of Vihiga district; the Friends Mission (Quakers) at Kaimosi in Vihiga; the Catholic Church at Yala in Siaya District; and the Mill Hill Mission in Kisumu; etc. Each of these mission stations had a school, since the missionaries were not only interested in converting the Africans to Christianity but also in teaching them how to read and write.

The encounter between the missionaries created also a class of people within Luoland who brought a wide range of changes to Luo agriculture. According to one of my informants, *Jaduong* Ogwang Madara, they were popularly known as *Josomo* (the educated) and *Jodini* (people of the mission). Together with returned migrants (*Jopango*) from white settlers' farms, they quickly helped to persuade people to change to the white man's ways of life. They equated those who were adopting crops such as white maize and cotton introduced by the Europeans as civilised and modern.

### **1930s until Independence**

The general picture of Nyanza agriculture at the end of the 1920s was of a province only just beginning to feel the impact of commercialisation. The 1930s were a period of considerable growth. The dominant influence throughout was the Depression with its strong repercussions for settler agriculture. The demand for labour in white settler farms against increasing African production was reduced by the weakness of their political position. There was more encouragement for African agriculture, which developed substantially despite depressed prices for its products. Wages were even more depressed and the comparative advantage of production in 'African' areas was undoubtedly strengthened. There were serious famines in 1929 accompanied by locust attacks on the land, and again in 1933 and 1934, and this led to an increased concern with famine reserve crops, which figured more prominently in the 1930s policy than they had before. In 1931 the locusts returned to Nyanza, destroying crops and precipitating the *Bonyo* Famine of that year. From 1931 to 1934 there was a disastrous drought in Kenya. The drought led to several crop failures in Luoland, which in turn led to the *Otwoma* famine of 1933-1934. Again, the most severely hit were the Luo locations immediately around the lake. The Government distributed maize flour free to the very poor, who were identified for the Government by the village headman. The rest of the affected people in Siaya District depended on cassava and potatoes grown in Alego, Lolwe and North Ugenya. Traders from Alego and Ugenya brought the crops to markets such as Yala, Akala, Ndori, Abom, Bondo and Nyamonye.

There was now a growing concern with soil erosion and deteriorating natural resources in African areas, which had a significant influence on agricultural policy even before World War II. It was during this period that land pressure also first became evident in some African areas. In the same period, the first extension workers came to Nyanza and were stationed in Maseno. The development of food production intensified and famine reserve crops, particularly cassava, were encouraged. With the fall in output from the European farms, African areas began to be seen as useful supplementary sources of food and other crops.

Market forces were still much more influential than direct development policies or the influence of officials. There was a great deal of progress shown in the increased output figures, despite the very depressed policies that persisted and that discouraged settler agriculture so strongly during this period. There was substantial growth in marketed output in spite of the fall in prices, and coffee was introduced on a very small scale for the first time. There were attempts at destocking, which aroused strong political opposition in some areas, and soil conservation and rehabilitation of over-grazed land became important features of agricultural department activity in the 1930s. With growing land shortage from the 1930s onwards, stock numbers generally fell. This trend further decreased the significance of the loss of the labour power of young men.

Many of the early migrants continued to enter the labour market after marriage. From the 1930s onwards, most men were involved in migration. For men who had married, it became necessary to remain on the labour market for long periods to meet growing cash needs. They left many tasks that could not await their return. It also became essential for rural households to be held together and the land protected and managed in their absence. And yet despite the loss of male labour power, agriculture appears to have been quite resilient in the 1930s (Hay, 1972). Mass migration coincided with viable food-crop production, probably owing to an expansion of female labour time.

After the early 1930s, Luoland was set on the road to the marginalisation of agriculture as a source of income. As more and more labour was withdrawn from the land a downward spiral of agricultural decline and ever-increasing migration to maintain subsistence was initiated<sup>2</sup>.

---

<sup>2</sup> Other factors contributed to the declining ability of agriculture to provide adequate cash income. The fixed boundaries placed on the reserves by the government led to population pressure on the land and, hence, to shorter fallow periods and declining soil fertility, lowering yields. The switch to maize accelerated soil exhaustion, because maize depletes fertility more rapidly than the indigenous crops of sorghum and millet.

Coupled to the direct loss of male labour power through migration was the slow process of a reduction in female labour time expended in agriculture. Falling food production forced women to spend increasing amounts of time in off-farm economic activities, particularly in trading and handicraft production. In the households where remittances covered shortfalls in food production, people were not forced to look for other sources of income to the same extent, but they also had a much greater incentive to invest resources in their children's education rather than agricultural production (Hay, 1972; Kitching, 1980; Francis and Hoddinott, 1993).

Margaret Jean Hay uses a distinction between women's roles as owners, and as occupants and managers of property, to argue that women in western Kenya during the colonial period shouldered much of the burden of household reproduction. At the same time, economic decline eliminated the grain surpluses that had formerly been one of their few avenues of control over resources and property accumulation. Instead, women took on the roles of occupants of household land, validating and protecting men's rights in land, and became *de facto* farm managers. Women in poorer areas become placeholders (Hay, 1982; see also Hay, 1976). Hay's analysis prompts consideration of the relationship between women's changing responsibilities, their access to and control over resources, and the origins of economic decline. Moreover, the commonality of experience in poorer areas described by Hay is complicated by a diversity that reflects processes of differentiation. These processes have been at work since the earliest years of colonial contact, although not in the ways suggested by Kitching (1980) and Francis and Hoddinot (1993). Finally, reorganisation of households cannot be viewed statically. Since the 1930s there has been a series of changes in the political-economic context in which divisions of labour have operated. Some of these changes have arisen through contradictions to which divisions of labour have themselves contributed. Changes of power relationships within households have been neither uniform nor unilinear.

In Nyanza, there was a rapid expansion of cotton production in the lower areas around the lake, and with this emphasis on cotton, the 1930s saw the real growth of cotton output. The value of cotton exports reached 90,000 pounds sterling from Western Kenya as a whole including Luoland in 1938 (Kitching, 1980: 74-78). This was due to market forces. In Kitchings' argument, the data on prices for cotton per unit output showed them to be significantly in excess of those for maize or beans. He noted for example that in 1936, when cotton prices fell below 10 cents per pound, the value of some 3,000 tons of marketed output was still over four times greater than that of an almost identical amount of maize (*ibid.* 74-78). Another factor that contributed to the high uptake of cotton during this period was the self-commoditisation on the part of farmers, without

much pressure from the state. Commercialisation and monetisation had taken root in Luoland and the need for money to meet necessities such as school fees; paying taxes and buying clothes were now pressing on individuals. Other substantial exports from Nyanza to the rest of the colony and to the international market included hides and skins, and then maize, sesame, ghee and millets (*ibid.*).

#### *The Second World War and Beyond*

When World War II broke out, the colonial government in Kenya shifted emphasis from cash crop production to food production in order to meet war requirements. The immediate need to defend Kenya from Italian invasion led to a tremendous expansion of the King's African Rifles. Throughout 1940, 1941 and 1942 the Nyanza Provincial administration was pre-occupied with nothing but 'obtaining recruits and supplies for the army' (Kenya National Archive, 1940, 1941, 1942).

Many Luo men, believing that they would be forced into the army, opted to leave Nyanza on their own to seek work on settler farms. By the end of 1941 some 91,218 men from Nyanza were working outside the Province. In that year some 5,131 young men from Nyanza were recruited into the army. In the same year a lot of foodstuffs, including 553,771 bags of maize, 27,126 bags of finger-millet, 65,000 bags of sorghum and 12,679 cattle were exported from Nyanza to meet the war effort (Kenya National Archives, 1941). Consequently, the higher prices paid for maize as an incentive for food production in the war years, undermined cotton production in Nyanza (Fearn 1961).

In 1942, another 544,446 bags of finger millet and 483 tons of fish were bought by the Government. Here was a situation in which the Government was depleting both labour and food surpluses from the Province, without paying any attention to the Province's internal food situation. When, at the end of 1942 the short rains failed, the Government had already disposed of Nyanza's food surpluses. The following year the Province was plunged into one of the grimmest famines it had ever experienced, the *Otonglo* famine. This famine, and its effects, lingered on until 1945. According to my informants, quite a number of people died, particularly in Seme, Asembo and Uyoma.<sup>3</sup>

---

<sup>3</sup> Indeed the Food Shortage Commission of Inquiry was set up by the Governor in 1943 to investigate the causes of this disastrous famine, which had also affected large parts of Kenya. In an apologetic letter to the Chief Secretary in January 1944, Nyanza's Provincial Commissioner, K.L. Hunter, blamed the 1943 famine on the provincial administration's inability to estimate accurately the already vastly increased rate of food consumption in the Province. He observed; 'as late as October 1941 attention was apparently directed to arranging for disposal of a surplus rather than forestalling a shortage of maize'.

By the end of the war, Nyanza Province had emerged as a major maize producing area. In 1944 and 1945 Nyanza sales were worth over 250,000 sterling pounds and they dwarfed all other exports from the province. Hides, skins and cotton were still important exports but far behind maize. Ghee, millets, eggs, groundnuts and rice also featured prominently. In many parts of Nyanza large surpluses of maize were produced in monoculture, which led to a much more serious concern with the exhaustion of soil resources due to excessive maize cropping. This also coincided with an increase in labour migration from the Nyanza region (Stichter, 1982: 116-119).

During this period, the vast majority of Luo migrants did low-paid work, first mainly on the European farms and plantations and later in the urban areas. However, a few men with some primary education gained access to better-paid work as teachers, clerks and other work in the administration.

Inequalities in income from employment did not at once bring about differentiation in levels of farm production or striking differences between the roles of women in different migrant households. The wives of most migrants remained in Luoland, providing the household food supply from farming and undertaking seasonal trading to meet some of their needs. Most wives of migrants took on this role because their husbands were too far away, for too long, to play much of a role in day-to-day household decision-making. But there was no evidence that wives of better-off migrants were able to use remittances to expand farm production to any significant extent.

Few migrants invested in farming beyond the replacement of their own labour power. Instead, migrant remittances were at first spent on taxation and consumption goods, and invested in bride wealth. Migrants in better-paid employment also made other investments, largely in cattle and school fees. Growing land shortage and low returns to farming discouraged much investment in additional wives, and many of the cattle acquired appear to have been invested in school fees. For non-migrant men, they accumulated resources through farming, if he is involved in cash crop production, fishing and trading.

Between 1949 and 1953, the colonial government tried to revitalise cotton production in Nyanza but the preference for maize as a cash generating and preferred food crop prevailed among the farmers. Thus, the potential for cotton production that had been identified in Western Kenya never got a chance to blossom fully. One reason to this was due to labour migration to Uganda or Nairobi and other Kenyan cities, which was viewed by Luo men as an important cash strategy for them than growing cotton. Women farmers concentrated mainly on growing food crops to meet immediate household food demands. More so they were already overburdened, as they had to take over also men's role who were now migrants.

*Post War Policy*

It became clear to the colonial administration that, in the wake of the Second World War and its aftermath, white settler dominance could no longer be sustained. Pressure exercised by foreign capitalist interest groups and the emerging African businessmen, articulated in a variety of ways and on different occasions, on the administration to revise its policies coincided with a considerable build-up of political unrest in the colony after the ending of World War II (Hebinck, 1990: 57). The post war policy had a new emphasis. At the end of the war there was an atmosphere of crisis regarding the preservation of soil in the African areas, many of which had deteriorated visibly during the war. There were public statements, several of which were extremely alarmist, but there is no doubt that all of them contained some degree of truth (Heyer, 1975: 143). Translated into policy terms, soil conservation was to be paramount, even to the detriment of incomes in African areas that were bound to suffer as a result. The strategy was to rely on reduced cropping, increased 'mixed farming', the use of manure and compost, the introduction of crop rotations, fallows and grass leys, destocking, physical soil conservation measures; and the rehabilitation of grossly denuded areas. In many areas it was thought that this could only be done in conjunction with the removal of population to new areas of settlement, and these were to be investigated. The intentions were clear and often stated in strongly paternalistic and moral tones.

However implementation was not easy. Food shortages and high prices continued well beyond the end of the war, putting irresistible pressure on continued and increased intensive cropping. Agricultural officials stepped up the soil conservation campaigns relying on physical soil conservation measures, many of which were enforced and extremely unpopular. In the latter part of 1940s increasing attention was also being paid to marketing, and the implementation of the elaborate system of marketing controls that had been introduced during the war.

With regard to livestock development in Nyanza Province, the Department of Agriculture was proposing adoption of goats for milk and meat as early as 1947 for areas that were too densely populated to keep cattle (Kenya National Archives 1947-1951). However, this proposal did not take effect until quite recently. During the same period, a proposal was launched to introduce high-grade dairy cattle to the 'progressive' farmers in Nyanza. However, the stringent conditions imposed greatly reduced the possibilities for adoption. Every farmer who wanted to buy a grade animal either had to own a stirrup pump or have access to a dip, as well to persuade his neighbours to maintain the same livestock management techniques to avoid tick infestation.

*The Swynnerton Era - the 1950s*

The Swynnerton Plan, completed in 1953 and published in 1954, was the response to increasing land tenure problems and mounting political pressure from the African population. It provided the definitive statement on land tenure policy and set out a policy to expand cash cropping in African areas as part of a general policy of maintaining and increasing incomes simultaneously with improving land utilisation techniques (Swynnerton, 1953: 16-68, Heyer 1975: 156; Hebinck, 1990: 59). The Plan represented a new phase in African agricultural development policy. It envisaged a vastly increased rate of expansion of cash crop production; the introduction of new crop and livestock enterprises, and it was notable for its strong emphasis on increasing income.

The Swynnerton Plan actually responded to an earlier call for land tenure reform by the Young Kavirondo Association. As early as 1921 they were pushing for individual land tenure (Anyang' Nyong'o, 1981). At that time, however, the colonial government ignored these demands. Furthermore, the majority of the Luo did not share the quest for individual land tenure, as it was contradictory to their customary way of arranging and distributing plots.

It is noteworthy that during this period, even though the colonial government had not officially instituted land registration policies in the African areas, modern courts were encouraging the so-called progressive farmers to enclose land for individualised use in some regions. For example, in central Kenya where land laws were enforced very stringently in order to appropriate land for European settlement, there was increasing population pressure, which in turn stimulated political agitation among the indigenous population. This situation necessitated intensification of agriculture within the African areas. In the circumstances, progressive farmers were encouraged to close communal land for individualised cash crop production. This strategy would simultaneously increase agricultural productivity per unit area, as well as create political support for the colonial government in the face of growing unrest among the masses in the region.

In contrast, there was very little appropriation of land in Nyanza Province. Consequently, politics in the region did not focus on land or even on agrarian issues for that matter. There was therefore little pressure on the colonial government to intervene in agricultural matters. Even in the 1950s, when the Swynnerton Plan was launched to intensify African agricultural production, Nyanza did not attract optimal benefits.

This was partly due to the opposition raised by the African leadership from Nyanza Province (Kenya National Archives, 1956-1958). More specifically, the Luo Thrift and Trading Corporation (LUTATCO) must be singled out as the spearhead for opposition to land consolidation and registration (Anyang' Nyong'o, 1981). One explanation given for this conduct is that emerging



African merchants took advantage of the situation to cement their political alliance with peasant farmers in order to combat Asian commercial interests, settler interests, and the colonial state, whose rules and regulations denied them both access to business loans and more lucrative areas of trade. Opposition to land consolidation would undermine colonial plans for the region, and thus enhance the political stature of the merchant class as power brokers in the region. At the same time, failure of the programme would curtail the chance for local chiefs and their henchmen to consolidate their land acquisitions and thus undermine their chance to crystallise into a viable class in the agricultural sector.

Peasant households joined forces with merchants and other more enlightened businessmen in opposing land consolidation and registration for fear of losing their inheritance rights. It is noteworthy that traditionally, plots of land were allocated in a way that enabled sharing of the land to take into account its distance from the river, thus ensuring equal allocation of plots suitable for different crops and for different seasons (Odinga 1967: 14). This strategy of land allocation was particularly appropriate in the drier zones of Nyanza, where the frequency of crop failure was high and where having plots at different locations minimised the risk of total loss. Land consolidation was expected to undermine this traditional land allocation procedure. The traditionalists also wanted to preserve the authority of the clan elders as the legitimate custodians of clan land.

As a result of the opposition to land consolidation and registration in Nyanza, in 1958 the colonial government adopted a 'self-help' policy (Dupre, 1968). This meant that private individuals could mobilise willing members of their communities to consolidate land. The colonial government refused to stand firm as it had done in central Kenya, and insist that local communities had to approve consolidation unanimously. If and when there was sufficient interest, government officials would intervene to offer any required assistance.

It is important to understand that the Swynnerton Plan was conceived in the wake of 'Mau-Mau' activities in response to land alienation and overcrowding in Central Kenya. The general idea behind the plan was to provide money to help intensify African farming and thus entice the recipients away from 'Mau-Mau' activities (Hebinck, 1990: 58). However, the situation was different in Nyanza Province. Increasing population density in the region could not be directly associated with colonial occupation because there had been minimal land alienation. Under these circumstances the Swynnerton Plan was probably not conceived with Nyanza Province in mind. Little wonder then that the implementation of the plan did not appear to benefit Nyanza Province as much as it did central Kenya.

The Swynnerton Plan set out a policy to expand cash cropping in African areas as part of a general policy of maintaining and increasing incomes. Apart from cotton, other cash crops that became part of the Nyanza landscape were coffee, which was grown on a small scale, and sugarcane, introduced by the Asians. Exotic dairy animals also started to appear in some farmers' fields. Alongside the cash-generating innovations, the Swynnerton plan embarked on soil conservation programmes. This was an important aspect of agricultural activity in most areas, including Siaya.

In spite of the difficulties of comparison there are some clear broad trends. The most important historical trends since the second world war have been the slow growth in agricultural production, increasing the need for cash to buy food and, alongside it, a dramatic rise in the number of essential household items and expenses which can be met only with cash. These trends have made differences in access to remittances from the urban areas more and more important causes of inequality.

Better paid migrants and the group of relatively successful non-migrants all made children's education their main investment, as it became increasingly clear that education provided the route to upward mobility. An increasingly stagnant local economy removed farm and off-farm rural activities as a source of accumulation comparable to better-paid wage employment. Some of the children - particularly those who finished their education in the late 1950s and 1960s, when the upper reaches of the labour market opened up to Africans - were able to get professional employment. Their fathers' comparative prosperity had been translated into an advantaged position for the next generation. These people are now almost all employed in the urban areas. Access to their remittances, together with pensions, is the chief factor determining the distribution of income in the community today. On the whole, though, their material links with the community are not strong.

The region's earlier exposure to cash cropping was consolidated in the late colonial period and immediately after independence. Excellent markets for maize developed during World War II. This was the time when grinding mills were built and attractive prices for maize were fixed. Local markets for staple foods emerged due to the expanding wage labour force in the region. Commercial rice production was introduced, and some swampy areas were drained for this purpose.

Throughout the 1950s and 1960s, the district was a net food exporter, with an important component of informal food export to the cities for Luo labour migrants. In response to economic incentives, permanent cultivation developed using minimal fallow. Better-adapted sorghum and millet, even in the drier zones, replaced maize, and new husbandry practices, such as frequent tillage were adopted, which exacerbated soil erosion.

**The Post-Independence Period (1964-present)**

This has been a period of unsustained growth. Independence brought no lasting and fundamental change in the socio-economic conditions of the Luo. The prevailing trend of stagnation, or better still, of negative development remained intact. What did make a profound impact on the areas though was the drive to Africanise the country's private and public sectors, which for some time succeeded in opening up a sizeable number of jobs for Kenyan citizens who enjoyed some degree of formal education. Together with the ongoing process of rural impoverishment and a vast expansion of schooling facilities throughout the Republic this development increased the flow of peasant migrant labourers and intensified their search for better remunerated off-farm jobs. This time the search did not limit itself to the earlier White Highlands, but shifted to the towns, to Nairobi and Mombasa foremost, when restrictions on African settlement in towns were finally removed. The rate of success in the quest for employment generally depends on the educational level of a would-be entrant to the formal employment sector and on the length of time his home area has been actively engaged in labour migration. The latter factor determines the amount and quality of help he can hope to get from relatives and fellow clansmen who already live in the towns.

Development in Luoland after independence was disappointing in contrast to the rapid rate of development in Central Province, which is mainly inhabited by the Kikuyu. Luoland did not have such large areas suited to the expansion of the cash crops hitherto prohibited, and in much of Luoland there was lack of suitable high value products on which a faster rate of development could be based. Coupled with this was the fact that Luoland's more limited development opportunities had already been more fully exploited than had those in Central Province. Until 1955, the major product from Luoland was maize, after which the value of marketed maize fell and other products grew in importance. Other products that were important were cotton, coffee, hides and skins and, for a while, groundnuts, but coffee never became as important in Luoland as in the Kikuyu-dominated Central Province.

After independence, Central Province forged rapidly ahead and has remained well ahead ever since. The basis of this dramatic increase in marketed output after independence was coffee (Heyer, 1975: 160). Other products became significant sources of output growth in the 1960s, but coffee was the first and most sensational source of growth and indeed in marketed output from small farm areas as a whole. This rapid expansion can be attributed to a number of factors. Central Province had been held back from growing the cash crops for which it was most suited, and once the restrictions were relaxed in the early 1950s the province quickly went ahead to exploit the potential. At the same time

as restrictions were relaxed, the province received a substantial increase in development resources during and after the emergency period of 1952 (*ibid.*: 160). The infrastructure developed to help control the political situation greatly benefited agricultural development. Similarly, the increase in agricultural services associated with the political situation made a considerable contribution. It was at this time that land consolidation and registration of titles also took place. These factors combined with the complete reversal of policy with respect to coffee and other high value products enabled the Central Province to gain a dominant position by the time of independence, which it has retained since.

As population increased among the Luo, hand hoeing became increasingly the major land preparation method. With fewer cattle and less land available, the Luo could no longer increase their agricultural output by adopting ox-ploughs to cultivate larger fields. As the area was becoming densely populated, they were forced to intensify production practices to obtain higher yields per hectare. Consequently, when maize varieties with high yield potential became available, the Luo quickly adopted them. As maize is also far easier to cultivate by hand hoe, farmers soon substituted finger millet for maize.

With labour migration, processes of differentiation have given rise to a fairly wide spread of incomes and to striking contrasts between the ways in which rural households get cash. There are 'households' that get the bulk of their cash from their farms, a medley of off-farm activities and transfers from kin and friends. Households that depend for their cash income on the urban areas are badly affected by crises in the urban labour market. A household's endowment of land and the ability of its members to undertake more labour-intensive cash cropping, or off-farm activities, to a large degree determine whether it can meet its cash needs.

In their efforts to get cash, people have followed a variety of strategies. Moreover the effectiveness and popularity of the strategies available have altered in response to the changing political-economic context. Farming was never a source of large-scale accumulation in my research villages, although a few households successfully combined farming and rural off-farm activities. Their children then moved into relatively well paid urban employment. For most, farming has been a backstop, combined with urban jobs, but this is becoming more precarious as farm production and urban job prospects fall. Poor returns from rural off-farm activities, and low remittances from their children, have prompted some retired migrants to try the intensive cultivation of vegetables. They have recently been joined in this activity by some of the younger men who have given up trying to survive on the urban labour market. In these households farming is much more than a holding activity. But cash cropping is a strategy demanding great efforts for low and risky returns. Also,

prematurely returned migrants usually have the smallest land holdings, because they belong to a generation that inheriting a portion of the already smallholdings of their fathers. Many younger men are not prepared to follow a cash-cropping strategy, and rely for money on odd jobs and petty trading. Their wives grow a small amount of food on tiny plots and otherwise rely on petty trading and transfers from relatives and friends for food. The precariousness of this way of life hardly needs to be pointed out. After experiencing it, many young men return to try their luck again on the urban labour market. It remains to be seen whether return migration by younger men will eventually become permanent - as they decide that the search for urban employment is hopeless - or whether they will continue to move back and forth between the rural and urban informal sectors. Remittances were spent mainly on consumption and investment in education. But more recently, falling urban real wages and growing urban unemployment and underemployment have put a strain on rural-urban linkages of this sort.

In 1963, Kenya achieved its independence from the British. Jomo Kenyatta, a Kikuyu politician from Central Province, became the first president, with Jaramogi Oginga Odinga, a Luo, as his vice-president. However, as the 1960s progressed, politics was increasingly conducted along the lines of tribal affiliation. The Kikuyu forged ahead of other ethnic groups in terms of securing jobs in all sectors of the government and above all in the private sector. Areas of the country where opposition to the government was strong were threatened, and to some extent actually punished by reduced levels of public spending. Loyal areas, including Kikuyu districts, were relatively favoured. *'Ethnocentrism' gradually acquired as a result a new meaning and was certainly itself a very real factor in political and economic life* (Leys, 1975: 204).

In the first three years after independence a major preoccupation of the regime was to conciliate and absorb into the neo-colonial system the 'hard core' of forest fighters by means of land grants, and jobs in the army or government. Since Mau-Mau fighters were largely drawn from the Kikuyu ethnic group, Kikuyu leaders took advantage of this to allocate themselves large parcels of land, with the claim of being the legitimate successors of the martyred leaders of the forest fighters. The Kikuyu bourgeoisie were well aware that many of their special advantages depended on their political dominance within the state apparatus. So long as enough of the Kikuyu masses believed that this was also of prime importance to them, appeals to tribal solidarity would serve the double purpose of reinforcing the Kikuyu leadership's position at the centre, and repelling challenges based on class antagonism within Kikuyu society (*ibid.* 204). During the Kenyatta regime, agrarian politics in Kenya was mainly aimed at marginalising regions that were not supportive of the government by simply sabotaging the markets for both their farm inputs and out puts. As Leys (1975:

239) puts it *'the provincial commissioner did not hesitate to say: 'People who criticised the government and yet had been given loans to buy farms and open businesses would forfeit them'*. Very few Luo had the privilege of obtaining loans during those times or of venturing into business without political harassment. The rest were also harassed politically.

These tribal disparities led to tension between Jaramogi Oginga Odinga and the Kenyatta-led government, which led first to his resignation from the vice-presidency of the ruling party, KANU, and finally, in 1966, from the Vice Presidency of the country. Jaramogi then formed his own political party, KPU, which became the main opposition party. In 1969, Tom Joseph Mboya, a senior Cabinet Minister, and a Luo, was murdered. The motive for his killing was seen as political. This widened the rift between the Luo and Kikuyu as it instigated protest countrywide against Kenyatta and the ruling Kikuyu ethnic group. In the same year Odinga's party was abolished and its members detained without trial. When Arap Moi took over the presidency after Kenyatta's death in 1978, things did not really change. During both the Kenyatta and Moi regime the marginalisation of the Luos from mainstream politics continued, along with development projects that had been earmarked for Luo Nyanza. Cash crops introduced in Luoland to improve the economic status of the people were increasingly plagued by inefficient state intervention as well as failing and inefficient markets. The marketing boards partly played a role in this by (some would argue

intentionally) delaying payments to farmers for the produce they delivered to state-controlled markets as well as agricultural co-operatives. This led farmers to progressively distance themselves from growing such cash crops.

Markets became even more inefficient in the 1990s when the International Monetary Fund and World Bank pushed the agenda of Structural Adjustment. The state was forced, through the withholding of credit programmes and foreign aid support, to relinquish its control over the operation of markets and to set in motion a process of privatisation. While Structural Adjustment was meant to increase the efficiency and effectiveness of markets, the outcome in large parts of Kenya was actually counter productive. Due to corruption (many high placed civil servants were appointed as managers of these newly privatised business) various commodity markets and co-operatives started to collapse. This effected the operation of input and output markets almost countrywide. The once blooming sugar industry in Nyanza, the coffee sector, and the textile industry in Kisumu collapsed almost completely due to these processes.

There were many changes in agricultural practice in Luoland by the end of the 20<sup>th</sup> century, influenced by factors such as changes in land ownership, migration, increased population density and changes in social values. Some

farmers also cite changes in climate, particularly rainfall reliability, as another reason for changing agricultural trends.

Intensive exploitation of land for commercial food crops unaccompanied by soil-protection practices, have led to soil erosion and fertility decline. During the 1970s and 1980s this trend accelerated and crops yields in many places fell. Soil degradation is now widespread. Most farmers use animal manure for soil fertility, but supplies are increasingly limited. In Siaya, an impact survey of the Agro-forestry Extension Programme of 1989 showed a fifth of smallholders using no soil fertility improving practices at all on many fields. Fallow vegetation has changed and today it is common to see trees such as *Harrisonia abyssinica* or *Lantana camara*, indicators of degraded soils, on remaining fallow lands.

Food crop cultivation is at present the major agricultural mainstay in Siaya. The shift in importance from cattle to crops has been attributed to a number of factors. Migration of the male population is said to have led to a rapid decline in livestock numbers. Women were not traditionally prepared to manage cattle and were therefore unable to maintain large herds. In some cases, women followed their husbands to town and livestock were disposed of. Population increase necessitated the cultivation of more land thus leaving little land for grazing. For this reason, larger herds are found in the relatively thinly populated areas around the lake region rather than in the densely populated areas of the highland regions of Nyanza. In areas that have undergone land consolidation, private land tenure has eliminated communal grazing and thus restricted the number of animals any one farmer can keep. In terms of socio-economics, cattle were mainly kept as a sign of wealth, for paying bridewealth and for the production of milk. Due to incomes from urban jobs, most of the better off in Luoland are no longer necessarily cattle owners, and hence the traditional value of cattle as a sign of wealth has disappeared. Modern items such as nice houses and cars seem to have taken over as status symbols. Money is steadily replacing cattle for bridewealth so again there is no longer the necessity for parents to keep cattle in readiness for this event, and today a rapidly increasing number of young men in gainful employment pay their own bride wealth from their savings.

Land subdivision has left many farmers with inadequate land for subsistence needs. In 1989, the average area of cropland on smallholdings surveyed by the AEP ranged from 2.5 acres in the high rainfall zone, 3.1 acres in the medium-rainfall zone, and 4.3 acres in the low-rainfall zone with land size slightly larger in the southern part of the district (Scherr, 1993: 130). Many farmers had under two acres of cropland: 32% in the high rainfall zone, 41% in the medium and 27% in the low rainfall zone (*ibid*: 130). By 1999, this situation had accelerated

and most farmers were no longer subdividing their land to their sons. Instead most preferred block farming to reduce conflicts.

The main constraints facing Luo farming since the 1990s onwards have been rainfall unreliability, drought, shortage of land and labour (especially during peak periods), poor soil fertility, soil erosion, pests, diseases and weeds such as witch weed (*Striga spp*). Low yield levels, biological as well as economic, and few external inputs are characteristic of the farming system. The farming system is under considerable pressure from increasing population. It is no longer possible to maintain soil fertility on these poor soils at a sufficient level and there are few possibilities for fallow periods because land is scarce. Crop rotation cannot be practised either because most land has to be occupied by maize, the staple crop. Year after year, maize is grown on the same piece of land. This results in excessive *striga* growth, leaving the farmers with beautiful pink maize fields that produce very low yields. Fertilisers are too expensive to be applied to other than cash crops. For other crops people manure is placed in the planting holes, but not enough to restore soil fertility.

Luoland, a region of low to moderate soil fertility, has thus been subjected to problems ranging from political as well as economic marginalisation to what one might call an agrarian crisis emerging both from the ecology itself to structural constraints from the institutions meant to support it. The cash crops that might have offered the capital to plough back into farming have run into market problems that has left the Luo with little option but to concentrate on food crops, mainly at subsistence level.

## **Conclusion**

This chapter has examined agrarian change in Siaya district from the late 19<sup>th</sup> century to the present time as it has evolved from shifting cultivation via fallow-based farming, to permanent agriculture, mainly due to increasing population pressure and market integration. This pattern of change in Siaya is consistent with the model developed by Ruthenberg (1980) on the evolution of farming systems towards permanent upland cultivation in the semi-arid and sub-humid tropics.

Looking at changes in Luoland from the wider context of Nyanza Province, what emerges clearly is that smallholder farmers in this region of Kenya have been and are faced with an agrarian crisis with which they struggle with minimal success. Farmers resisted for a while the economic crops introduced by the colonial government in the first decades of the 20<sup>th</sup> century and later farmers took them up even though they were not sustained after independence. The rapid change that took place in Luoland in the late 19<sup>th</sup> and early 20<sup>th</sup> century made many Luo indifferent to some of the changes suggested by agricultural officials in the early colonial period. Their indifference was not due



to any opposition to economic change, as one might conclude, but that for some years they were preoccupied with adapting to and incorporating the far-reaching changes that had only recently taken place. For example, they resisted the introduction of cotton in the first decades of the 20<sup>th</sup> century because in competing for labour, it interfered with the cycle of food crop production. However, it was later adopted as a result of monetisation and self-commoditisation. The introduction of labour saving technologies such as English hoes, the hand gristmill to grind maize, and ox-drawn ploughs introduced by the colonial administration, enabled the Luo to increase agricultural production.

The famines in the 20<sup>th</sup> century played a large role in the adoption of certain technologies in the region. The famines were examined in terms of how both the Luo themselves and the colonial administration responded to them. The Luo responded by planting on their own account crops such as cassava and sweet potatoes. The famines also prompted the colonial administration to directly intervene in Luo farming practices, not only technically by introducing new, higher yielding crops such as white maize developed by the settlers, but also by encouraging the growth of cassava. Colonialism is not, however, to blame for all the food shortages in Luoland. The Luo, historically, mention famine as one of the many reasons which led to their incessant migrations before the colonial period. Traditional Luo eating habits also meant that they equated famine with the basic lack of grains, even when alternative foodstuffs were available. However, the colonial economy was axiomatically biased towards extraction - in transport costs, food pricing and taxation. Producing only migrant labourers, low cash incomes, and insufficient transportation meant that food shortages remained a chronic problem.

The last two decades of the 19<sup>th</sup> century following the migration of the Luo into highland areas of what is now Nyanza province around the 1880s marked the beginning of important changes in the economy. Three factors in particular helped to create a favourable climate for experimentation and innovation: - the greater agriculture potential of highland areas away from the lake shores, the encounter with Europeans (both administrators and missionaries) and increased contact with the Abaluhya and other neighbouring people. During the pre-colonial period, most parts of Luo Nyanza constituted a core area for pastoral subsistence production. The collapse of a purely pastoral economy, the military power of the Luo towards the end of the 19<sup>th</sup> century, and the imposition of colonial rule significantly changed the balance of forces in the area. The Luo had to shift from pastoral forms of production to agro-pastoralism and then to permanent upland agriculture. The major impact of colonial rule was also an enforced change from a natural subsistence based economy towards commodity production with the sale of stock and grain,

initially to pay taxes but increasingly to purchase necessary commodities such as tools and consumer goods. Due to population increase, agricultural intensification took place, which led with time to environmental degradation, manifest in the decline of agricultural production and household food insecurity towards the 20<sup>th</sup> century.

In what is now Nyanza province, large-scale labour migration began in the early decades of the colonial period, at first stimulated by force and by new cash needs (taxation, clothing and cash to purchase bridewealth cattle, etc). Labour migration involved upheavals in domestic relationships, but they have not been unilinear. Broadly speaking, the advent of a migrant-labour economy initially threw much of the burden of household reproduction on to women. Declining agriculture and rising urban wages in the 1950s and 1960s together promoted a growing role for remittances from migrant males in the reproduction of many households. More recently, rising urban unemployment and underemployment, together with falling urban real wages, have put an enormous strain on the links between urban and rural Siaya people. Many women, again, are shouldering responsibility for household reproduction. Patterns of change have been subject to profound long-term changes. Constraints, opportunities and individual strategies have altered. Very broadly speaking, some women have become economically more dependent on their husbands.



## Kinship, land and agricultural practices among the Luo

### Introduction

This chapter maps out how kinship and customary law of the Luo of Western Kenya at present mediate people's social relationships and practices regarding land, labour and agriculture practices. Changes that take place in the Luo social and cultural landscape are closely related to the history of the clan and lineage formation (patrilineal with matrifocal units as well as friendship) as well as to the settlement or 'occupational landscape' (e.g. the gradual transformation from the ancient fortified villages, *gunda bur*, to the present village, *gweng*, in the wake of British expansion) and to residential patterns (from *gweng* to homestead (*dala*)). In addition, issues related to land acquisition (field allocation, inheritance and distribution) and the organisation of agricultural labour (from labour groups such as the *saga* to family and sometimes wage labour) are intrinsically embedded in Luo cultural repertoires. Agricultural practices such as 'first sowing' (*golo kodhi*) are based on seniority and remain important elements that shape agriculture to a large extent despite modernisation, labour migration and the increasing influence of churches. Such changes can only be understood with reference to the gradual changes of Luo kinship relations.

Kinship represents what may be called a general organising principle of social life, or an ideology, and kin relations are intertwined with customary law. They are not frequently referred to, due to the fact that modern state laws have taken over some of their functions and the Luo life style is ever changing as a result to their interaction with people from different cultures. However, they are resorted to when conflicts and problems occur that may upset the social fabric of the Luo. Customarily, land is regarded as being the inalienable property of the clan, to be inherited according to lineage membership. Fieldwork has revealed, however, that conflict and ambiguity often surround land issues. This can be partly explained by the fact that customary land tenure arrangements have been reshaped over the years by the introduction of private land ownership, which dates back to the colonial period, and more specifically to the Swynnerton Plan implemented from the 1950s. Land, customarily belonging to a lineage and given in usufruct to a lineage member, is now formally regarded as individual property. It is registered, and title deeds are issued according to modern state land laws. This has opened doors for the sale and the acquisition of land outside the realm of customary law, but if the 'owner' wishes to sell the land he still needs the consent of the council of village elders. Thus, a situation has evolved whereby customary and private land

tenure arrangements are welded into the way the Luo deal with land, understand land issues and resolve conflicts over land. Currently, land conflicts take place in arenas where the two different systems of land tenure form the background for different claims and interpretations.

The first part of this chapter deals with the Luo settlement pattern and how this has changed over time with population expansion. In terms of agrarian change, it is necessary to understand how the settlement patterns have changed over time. The second part of the chapter analyses Luo kinship ideology with reference to land allocation and inheritance by drawing on existing published ethnographies as well as on local people's accounts gathered during fieldwork. It explores the contemporary practices of land inheritance and acquisition and the influence of private land tenure. The third part of the chapter then deals with the problems of labour in the research villages and the fourth discusses the relation between kinship and agricultural practices. The fifth part of the chapter introduces the cases and shows how kinship relations also serve to elucidate the complex set of social relations by which the Luo engage in production, distribution and consumption of resources and material goods. Case material on conflicts associated with land, labour and agricultural practices will be used to illustrate how kinship and customary law still structure daily life. In the conclusion I elaborate also on the practical implications of such an analysis for research and development purposes.

### **The Ancient Luo Villages**

The earliest known settlement of the Luo in Kenya was *Ligala* in Samia, a little West of what is now Siaya District. Because of insecurity brought about by inter-clan and inter-ethnic warfare no family could live in isolation. The Luo, therefore, lived in fortified villages known as *gundni bur* (singular: *gunda bur*). They had walls of earth that were 3 to 4.5 metres high and about 1 metre in depth. Large deep trenches about 2 to 3 metres deep surrounded the *gunda bur* and inside, lived as many as 40 families. Women and their daughters cultivated the land near to the *gunda bur*. The elders and warriors went to more distant areas to graze cattle (Oloo Aringo, 1969). The construction of *gundni bur* was necessary since the Luo migrated into areas that were occupied by other tribes, such as the Maasai and the Abaluhya (Ekeya and Akong'a, 1986: 135). This resulted in frequent raids by these tribes. Furthermore, warfare also took place between distant Luo groups. The *gunda bur* provided protection against these enemies and the trenches kept cattle raiders at bay.

In Nyamninia, Muhanda and Muhoho, landmarks of trenches and wall settlements, probably two to four centuries old, have been located. In Nyamninia village one can still trace the boundary of *gunda* Nyamninia, in Muhanda the old boundary of *gunda* Mudhiero and in Muhoho the old

boundary of *gunda* Mundowera. The Abaluhya constructed these ancient villages in my research sites, abandoning them as the Luos advanced. The Luos then became their inhabitants. Luero the fourth village was occupied much later when *gundni bur* had ceased to exist.

By the late nineteenth century, it seems, these particular fortifications had been abandoned and only sections of trench and wall configurations passing across, or broken by, maize and cassava fields in the three villages can now be noted. These *gundni* were compact settlements, providing a modicum of security for sizeable groups, stores of foodstuffs and cattle. They stand in contrast to twentieth-century enclosure in the region, which are fenced and constitute the residences of but small patri-groups. Older Luo often remark that before 1900 people did not go around building just anywhere on the terrain. The land was rationally organised, and people were settled in concentrated residential units (*gundni bur*). Defensive requirements were important, according to these expositions, while collective settlements and collective planning of the use of the land were critical. In this popular exposition of agrarian change, devastation of the landscape came with the *pax Britannica*, when the defensive uses of the *gunda bur* became less significant.

For the person of Siaya, 'landscape' is not a reference to the physiognomy of the terrain. Rather, it evokes the possibilities and limitations of space: encompassing the physical land, the people on it, and the culture through which people work out the possibilities of the land. According to Cohen and Atieno-Odhiambo (1989:9), "landscape" then means existence. 'Land' according to the Luo has several meanings; it can be *piny* (territory), *thur* (home ground), and *lowo* (reproductive soil). People - Luo people - are referred to as *jowa* (our people), *yawa* (our agnates), *langwa* (our valiant ones), and *kothwa* (our seed). 'Culture or custom' is referred to as *timbewa* (our way of doing things). A Siaya person thinks of home, *dala*, as a concept in which all these elements are interwoven into a fine seamless text; the texture of life in any *piny* (*ibid.*).

If the *gunda bur* represents the first phase of 'the transformation of the occupational landscape, the construction of *gwenge* (singular: *gweng*) represents the second phase. As the population of the *gunda* expanded, as a modicum of security was established in the area, and as wealth was reckoned less exclusively in such easily portable goods as cattle, the children of the *gunda* established new homesteads (and ones less well fortified) outside the *gunda*. The expanding local community is referred to as the *gweng*. A *gweng* can also be understood as a countryside settlement or village. The formation of *gwenge* is attributed by many to the pacification of Western Kenya by the British, which started in 1895 when Kenya became a British protectorate (Ogot, 1967: 238). However, in many areas, it seems that the gradual transformation from *gunda bur* to *gweng* had already begun at the beginning of the 19th century (Cohen and

Atieno-Odhiambo, 1989: 10). Apparently at that time the situation was already secure enough to move out of the walled *gunda bur* into the *gweng*. A *gweng* consists of a number of *dala*, homesteads or enclosures/compounds. Compared with the *gunda bur* social life was now organised in smaller social units, the *dala* or enclosure. Euphorbia trees fence the *dala*. The fencing has to be carried out by the founder and the head of the new enclosure, the *jaduong dala*.

*'Our village, like all Luo villages, was neatly fenced about by euphorbia trees or 'Ojuok' as we call them. Inside the circular village were twenty neatly built huts, forming a concentric circle within the fence. In the centre were four small huts that we regarded as the headquarters of the elders of the village. The one in the centre was the Duol or office of the Jaduong dala, or chief elder. He was Omuodo Alogo. Next to this hut was the office of Odinga, my father; then that of Oteke, the uncle of Omuodo Alogo; and the fourth belonged to a friend who had married one of our sisters and came to our village. Each hut in the village represented one woman. Elder Omuodo Alogo had six women, Odinga had five, Oteke had three, and so on. In all there were thirty-six children in the village'* (Oginga Odinga, 1969: 6).

In the Luo lifeworld a sacred meaning is attributed to the euphorbia fence. When the *dala* had to be extended it was only the *jaduong dala*, assisted by an *ajuoga*, a diviner, who was allowed to do this. This implies that, after the *jaduong dala*, the founder of the enclosure, had passed away, no one would ever be allowed to extend the *dala*. The *dala* had one main entrance. At the time of construction of the *dala*, the *jaduong dala* and the diviner would carry out a ritual that assured the protection of the enclosure by the ancestors of the *jaduong dala*. Ochieng Monye, a farmer from Muhanda, confirmed this when he told me that a thief who had entered the *dala* via the main gate, became completely confused and wandered about the *dala* the whole night, unable to steal anything. Those Luo rituals and beliefs can still be found today. However, as will be pointed out later, their encounter with new norms and values has often led to transformation and they are gradually disappearing.

Residence in a *gweng* is based upon kinship (Southall, 1952: 27) and upon alliances developed out of strategic considerations (Cohen and Atieno-Odhiambo, 1989: 14). For example, the utilisation of the alliance networks of the *gweng* in long-distance contacts was the motor of the Nyanza-Samia iron trade (Were, 1972). These alliances allowed safe travel, with the individual utilising interlocking social networks or *gwenge* through affinal relations and the *luth* travel insignia. Extensively and routinely utilised long-distance networks - heavily 'trafficked' networks - established the working bases of *ogendini* (tribes) (sing. *Oganda*) such as *Jo-gem* and *Jo-Ugenya* and they may, later on, have been steadily extended in range to bring a feeling of enlarged oneness and kinship to areas much wider than the *ogendini* territories. The rich materials of history, of past contacts, alliances, old marriages, coalitions, and descent could be sifted

and interpreted to provide an ideological and rhetorical basis for such constructions as the *gweng* and *Oganda*.

In the case of *dala* construction one can again perceive the result of the encounter of Luo and Abaluhya custom. Some of the homesteads constructed in the four villages where this study was conducted are rectangular, just like the Abaluhya homesteads on the other side of the border with Western Province. However, the 'real' Luo *dala*, as found in the Siaya heartland, are circular. As stated, an enclosure has one main gate. Opposite the main gate, at the back of the enclosure the hut of the *jaduong dala*, the head of the enclosure, was constructed. Next to his hut, the huts of his wives would be built. The *jaduong dala* was obliged to give each wife he married a piece of land where she could grow crops and that would remain hers as long as she should stay in the enclosure. The sons to this wife would later inherit this land. The *jaduong dala* also had his own piece of land called *mondo*, meaning 'property of the father'. The produce of this *mondo* belonged to the *jaduong dala* and would be stored in his granary (Wilson, 1961: 54). When daughters were born they would live in the hut of their mother, or together with (half) sisters in the hut of a widow beyond the age of childbearing (Southall, 1952: 19) until they got married and left the enclosure. When a son, born in the enclosure, reached a certain age he would construct his *simba*, or bachelor's hut, within the enclosure. According to custom each son, eldest, second, third etc. had a specific place within the enclosure where he should build his *simba*. Also within the enclosure one would find a kraal, where the cattle would be kept during the night and granaries where grains could be stored. In between the huts of the first and second wife a spirit shrine was constructed to honour the ancestors (Southall, 1952: 24). Probably as a result of the introduction of Christianity these spirit shrines have almost completely disappeared.

The social basis of the *dala* or enclosure was and is the family, consisting of the husband (*Jaduong dala*), his wife or wives and their children. However, it was and is not uncommon to find more distant relatives or even non-relatives living in the *dala*. When the *jaduong dala* dies, the eldest son would take over his position as head of the *dala*. If the eldest son was still too young or if there were no sons the widow would marry someone else (*Jater*), normally a brother of the *jaduong dala*, or another close relative (Southall, 1952: 23). The *dala*, however, remained the inheritance of the sons born in that *dala*. Should the new husband and the widow of the *jaduong dala* have a son, he would be entitled to a piece of land. When a son of the *jaduong dala* married, he would leave the enclosure to construct his own *dala* somewhere else. This son was and is entitled to a piece of the land of his father's *dala*. However, in the old days when land was still plentiful, sons would often clear a piece of wasteland and construct their *dala* there. After the other sons had married and left, the youngest son would remain



in the enclosure to care for his parents. After the death of the *jaduong dala* this youngest son would inherit the *dala*.

We can therefore say that, at the latest, by the nineteenth century a new pattern had been imposed upon the original principles of construction and occupation of the *gunda bur*. This involved sons leaving the *gunda bur* in turns - a process recalled as taking place in order of lineage seniority as opposed to uterine seniority - referred to as *goyo dala* (building a home). And the rituals of establishment of the ancient settlements, the chicken, the axe, father and son, are elements in twentieth-century ritual that are held to be continuous with the foundation rituals of the ancestral *gunda bur* at *ligala* in what is now the Kenya-Uganda borderland.

Even though the Luo moved out of nucleated settlements during colonial times, they still retain the big family ideal by which married sons are sometimes intentionally delayed from leaving their father's compounds since old men still want to be considered heads of large compounds. This, of course, delays married sons from making their own investments in good houses or large herds because the property acquired while he is still in his father's compound, in theory belongs to his father.

According to the new view, under the new order, the desire of each person to have his own domain became explosive; hence the expression 'Even cowards want their own space'. There was a proliferation of homestead building and reallocations of the functions of land. Soils once thought perfect for the growing of sesame became Ochieng's small estate, where he and members of his household planted maize and cassava. A millet field was similarly transformed into someone's enclosed space, where several different crops might be cultivated. According to this popular theory, the land quickly deteriorated; and the special resources and specialised production organised by larger social units were replaced by the monotonous repetition of small farms producing small amounts of basic staples. There is probably much truth in this presentation of rural transformation, though the period during which the *gunda bur* was being replaced by a new more atomised form of settlement probably lasted a century longer than this interpretation suggests, in many areas preceding the *pax Britannica*. An adjusted model would certainly include an intermediate stage during which people lived outside the old *gunda bur* but continued to work co-operatively across a much wider terrain, a pattern of production that the British encountered on their arrival, and labelled 'shifting cultivation'.

Curiously, this style of exposition overlooks the effect on the rhythm of production of coercive colonial taxes and labour demands, in which people in the countryside were forced to accept the logic of (not to say taste of) maize and cassava, over millet and sesame. The story is also focused on the central place of labour availability in the organisation of the Siaya, then and now. But the story

of the transformation, as it is told in all its variant and consensual versions, alerts us to the fact that dynamic change is part of the way people in Siaya compose and tell history. Moreover, it indicates they do not always present change as progress.

In spite of the fact that many men found employment or other opportunities to make a living outside Siaya and therefore migrated, population density in Siaya District kept on increasing rapidly. Overpopulation led to a serious shortage of land. This was an important reason for the emergence of a third phase, from the 1960's onwards, of the transformation of the occupational landscape after the *gunda bur* and the *gweng*. This phase is characterised by sons remaining in the *dala* of their father, even after their marriage. In some instances the sons are permitted to make a cutting in the ancestral fence and then build their main house facing an independent gate put together at the new breach. This has been a feature since the 1960's, and in common discussion it has come to be associated with Christian families. Christians in Siaya have found it easier to vary the protocol by stating that Christianity allows the variance on custom, though they cite no biblical source to support the proposition. The signposts of this new phase in the occupational landscape, producing essentially more, compressed settlements, are the homesteads of James Otieno, Charles Okeyo, Oluoch Agulu and mama Esther Olawo. All these homes are located in the research area.

According to Luo custom, these married sons must obey their father, the *jaduong dala*, since he remains the head of the homestead. Furthermore according to this custom, junior sons have to obey senior sons and junior co-wives have to obey senior co-wives. This is illustrated by the custom of *golo kodhi*. However, the willingness to obey has decreased.

On the basis of the foregoing one can conclude that the social composition of the Luo household, in its simplest definition 'the people that live together in a *dala*', is today enormously diverse. The basis for this composition remains the Luo nuclear family, consisting of the *jaduong dala* his wife or wives and their children. However, these days one often finds three generations in a homestead, since married sons in many cases remain within the homestead. It is also not uncommon to find more distant relatives or even non-relatives living within the home.

Another transformation involves the way in which people speak of a homestead or compound. There is a shifting toponymy. In an important sense, language has followed reality; as women have emerged as primary occupants of Siaya compounds (with husbands, brothers, and fathers far away as labour migrants), so there has been an increasing practice to refer to compounds by the woman's name. For example, people say, 'I am going to Abigail Ochuoga's home' as comfortably as they will say 'I am going to Sylvester Ochuoga's home'. The out-

migration of men has further complicated the situation. Migrant men often come back home for a few months a year, the rest of the time they live and work elsewhere. This out-migration of husbands and sons has in effect put women in the position of being household heads. This has changed their social position in Siaya significantly. In the old days female-headed households could not have existed. The *jaduong dala* would always be around and he was responsible for the management of the enclosure. In case of his death, his eldest son or a close male relative would take over. This of course does not mean that women in those days were powerless. They presumably had many ways of promoting and fulfilling their aims. However, these days women are publicly recognised as household heads. For example Gladys Awiti, a farmer in Muhanda village became a widow in 1975. She did not remarry. Her sons found employment in town and they moved there. Therefore she presently manages her own home. She grows crops such as maize and she has a zero grazing unit where she keeps a dairy cow. Nowadays it is common for people to say that they are going to the homestead of Gladys Awiti. This recognition has increased the room that women have to implement their own plans and to shape their own lives. However, it should be added that men still hold 90% of the title deeds in Luo land (Shipton, 1992: 370).

Another tendency that has changed the social position of women is that polygamy is not practised as widely as it was in the old days. This has been caused presumably by a change in attitudes, amongst others a result of the introduction of Christianity, and due to economic problems. When a man wants to marry another wife he has to pay bride-wealth, he has to provide his new wife with a piece of land and, in principle, he has to maintain her for the rest of her life. In monogamous marriages one often sees that husband and wife manage the farm jointly, without the traditional separation of plots. This means that women normally have more influence than in polygamous marriages where the husband, as the *jaduong dala*, most often tries to impose his will upon his wives, to minimise the disintegrating effects of *nyiego* or rivalry. In most polygamous marriages women still get their own plots to cultivate. For instance, the four wives of Erasto Muga from Nyamninia all have their own 0.5 acre piece of land.

The remoulding of authority in the Siaya rural household from man to woman has in this way begun a remodelling of the toponymic landscape of the countryside. Thus, a long distance has been travelled from the *gunda bur* in the space of a century and a half. In this regard, Abigail's home, the woman's home, represents still further a diminution of collective activity and planning in the Siaya countryside, for the new toponym separates the conceptual form of the location from the idea that the home or compound is formed out of, i.e. is a physical representation of the patrilineage.

### *Kinship relations*

A typical Luo homestead (*dala*) consists of a site where the monogamous or polygamous domestic groups build their houses, in the surroundings of which they have their fields. The smallest social unit in the homestead is the 'household'. A homestead is made up of at least two generations, the father and mother(s), and that of their offspring. Occasionally, households of brothers of the homestead's owner are also to be found there, as well as servants and 'strangers' (see Figure 1). Several homesteads make up a *gweng* and resemble what we now recognise as villages or settlements. Residence in a village is based upon kinship (Southall, 1952: 27), but also upon alliances developed out of strategic considerations (Cohen and Atieno-Odhiambo, 1989: 14).

The elementary social relationships are organised around the normative principle of patrilocality that cements the relationships between father, mother and their children. This unit is known as *jokawuoro*, that is, people of the same father. In situations of polygamy, relationships then start from the matrifocal unit, the *jokamiyo* that combines a mother, her sons and unmarried daughters as an independent set of people. The *jokamiyo* implies affiliation to the mother rather than to the father *per se*. In the monogamous situation, the position of the father is very strong, as there is no rivalry. In a polygamous situation, the position of the father is weakened substantially in favour of the mothers and grandmothers. To avoid confusion, we shall begin by describing each of the two units separately before dealing with higher lineage segmentations that transcend the homestead.

*Jokawuoro* appears in two forms: the monogamous family and the polygamous complex. In the monogamous setting, biological links cement social relationships, since both mother and father are the actual parents. Each unit operates as one corporate group and shares and distributes most of the domestic activities. Daughters are included only before their marriage, since they are not considered when it comes to the inheritance of wealth. The normative respect for age (i.e., seniority) is such that the eldest son has to marry first, then the second eldest, and so on in order of seniority; the same is true of the daughters. When the senior son marries and has children, he is the first to build a new and independent homestead.<sup>1</sup> When the father dies, the eldest son takes over the responsibilities of leadership of the family.

People descended from the same grandfather are known in Luo as *jokakwaro*. They share sacrifices under the leadership of the genealogical senior brother. If the eldest brother dies, the brother next in seniority takes over the leadership of

---

<sup>1</sup> The Luo call this 'liberation'. They distinguish, however, between two different forms. The first liberation is when a woman starts cooking in her own house in the compound of her father-in-law. The second liberation is when a man establishes his own homestead.

the *jokakwaro* unit. An implication of the responsibility and prestige of genealogical seniority is that it puts the holder into the primary position of first harvesting (*dwoko cham*), first sowing (*golo kodhi*), as well as of eating specified parts of an animal killed, which are usually the best parts.<sup>2</sup>

If Luo society were composed only of this line of groupings, the study would have been much easier. However, a most interesting complication arises when one considers a polygamous homestead, which is composed of a plurality of matrifocal units (*jokamiyo*) and which is formed by a polygamous ideology through the mothers' marital relationships with a common husband. The relationship between such matrifocal units is referred to in Luo terminology as *nyiego*. The word means 'jealousy' when it refers to the relationship between co-wives themselves, and 'rivalry' when it involves all in a matrifocal unit as a group against another, opposing group.<sup>3</sup> The matrifocal unit that combines a mother and her sons in the second generation is called *jokadayo*, 'the people of the same grandmother'. At this level, the rivalry and competitive relationships between co-wives and their sons starts fading. The position of the grandfather regains importance.

Beyond the grandmother and grandfather line, at the third and up to the fifth generation, the *keyo* appears as a next organisational form. People descending from the same great-grandfather make up a *keyo*.<sup>4</sup> The elders of the *keyo* act as representatives in disputes between various opposing *keyo*. They are also intermediaries between younger members and the ancestors and therefore act as foster father guardians. They form the first organised council to arbitrate land and boundary disputes between members of their *keyo*. At this stage, social control of the community is exercised partly through the authority of these elders and partly through the control over the means of accumulation, which the leader of the group protects. Control and accumulation of resources is a basic requirement for subsistence and competition in Luo society.

A next level in the lineage is the *limbaba*, which involves descendants of a common ancestor, usually from four to seven generations back. It is a maximal

---

<sup>2</sup> For the Luo living along the shore of Lake Victoria, it is the senior brother who can first own a fishing boat. Since it is he who communicates with the ancestors, he also conducts or leads the sacrifices of religiosity regarding the boat.

<sup>3</sup> The *nyiego* relationship often generates the various kinds of conflicts, competitions, envy, confrontations and even divisions that are so characteristics at various levels of Luo social organisation.

<sup>4</sup> According to Wilson (1961: 7) a *keyo* is made up of extended polygamous families tracing descent from a common great-grandfather. The point of division is descent from the hut of one of his wives. The members of each of them thus constituted sub-groups share a common grandfather and are rightly called *jokakwaro*, 'people of the same grandfather' (Ochola-Ayayo, 1976: 122).

lineage of landholding co-operating agnates and generally considered to be the backbone for settlement, household and family formation, and social reproduction (Pritchard, 1965; Southall, 1952; Parkin, 1978). Its members characteristically meet often at the *keyo* level to discuss the distribution of land titles, land conflicts and other property disputes. The Luo economic structure can be studied most conveniently in terms of the operation of the *limbaba* units, because these units define maximal frameworks for economic, social and political competition. According to Ochola-Ayayo (1976: 121) 'the Luo sum up in the *limbaba* all those forces of friction and competition, which weaken the solidarity of a lineage segment and lead to its further subdivision'. Thereafter, the next level is the clan (*dhoot*).

The polygamous ideology discussed above accounts only for the first three sets of wives in a polygamous homestead. A further complication is then encountered when more than three wives are found in a homestead. In the basic Luo polygamous homestead (see Figure 1) the house of the senior wife (*mikaye*) is at the centre back. The second wife's house is at the right hand side of *mikaye* and is called *nyachira*. Then comes a third wife (*reru*) whose house is on the left-hand side of *mikaye*. Women married after the first three wives are called *nyi-udi*, which means the daughters of the house to which they are attached. They also stand in juxtaposition and compete with one another.

When it comes to marriage, kinship relations and the seniority principle are of primary importance. Marriage is arranged between families of different clans. The Luo custom is that the senior son of the senior wife should marry first. When he is of age, he is first given a cow and a young bull, which lineage members take to the bride's homestead.<sup>5</sup> According to Luo custom, after having received his first two animals from his father, a son can obtain the rest of the bride-wealth from his father's brothers until he reaches the number of animals agreed upon between the two families. Bride-wealth is only drawn from the patrilineal lineage, particularly from the grandfather's or great-grandfather's line.

Daughters of the same mother also marry in order of seniority. Sometimes the eldest son of the senior wife is younger than a son of a junior wife, in which case the father must first begin the marriage payment for the younger son. He must take the cattle to the identified girl's homestead, and this is sufficient to pave the way for the older, yet genealogically junior, son to complete his marriage plans. This custom has sometimes been described as 'child marriage', in that both the bride and the groom may be only a few years old.<sup>6</sup> Bride-wealth

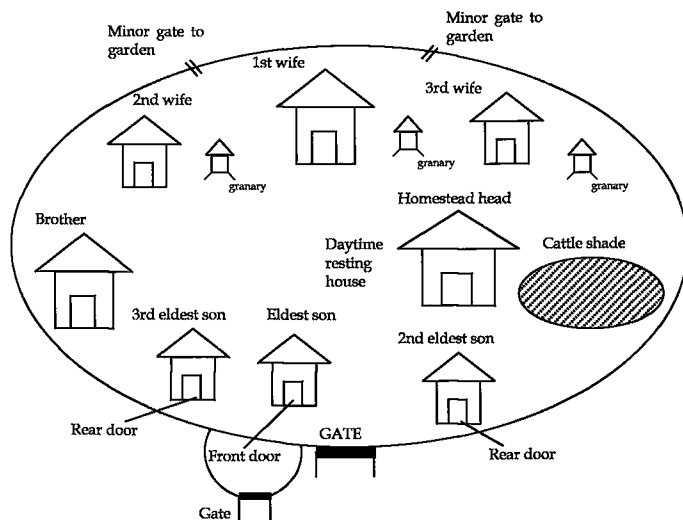
<sup>5</sup> The paying of the bride-wealth may start far earlier than the moment when the marriage arrangements are finalised, or even before there is talk of a marriage.

<sup>6</sup> The procedure is believed necessary to prevent *chira*, a disease caused by an act contrary to

is meant to cement social and kinship relations between families of different clans. Through marriage, two families become affines, and mutual exchange relationships are extended.

### **Luo customary land tenure arrangements**

There are several ways in which the Luo acquire land rights. The first derives from clan membership. Secondly, land can be allocated to strangers and, finally, slaves and servants can also obtain land.



**Figure 1. Spatial ecology of a Luo homestead**

Source: Ssenyonga (1997)

### *Land allocated to clansmen*

Among the Luo, the basic right to own land stems from being a member of a tribe in a given territory for which lineage or clan members and their ancestors fought, and that is 'once acquired by conquest' (Wilson, 1961: 18). This represents the strongest claim to land in Luo territory: every member of a clan has an inalienable right to cultivate a garden within the territory of his

---

customary law or usage.

grandfather. This right is normative because it is linked with lineage membership.<sup>7</sup> This is important socially, because it provides a sense of security, which springs from living among kinsfolk. It is economically important as well, because a clan member is entitled to occupy such land on terms of correct usage without payment, except customary dues to land-controlling elders.

The land that belongs to the clan is well defined by natural boundaries, and the natural landscape of ridges and valleys aids this demarcation. One clan usually occupies a ridge or part of a ridge. This now is the area in which a man from that clan may expect to obtain a right to cultivate and to raise stock. Formally, the land belongs to the head of the homestead. He in his turn allocates land to his wife or wives and keeps that part of the field closest to the gate for himself. Before they establish their own compounds, sons work on their mother's field(s). Below we will discuss how sons inherit land.

#### *Land allocated to strangers*

A person who comes to the area of a clan other than his own and asks for land is called *jadak* (stranger). According to Luo tradition, it is difficult to refuse a stranger the land he requests to provide for his subsistence. It is this tradition that allows people to live among tribes or clans other than their own. Friendship, or maternal or affinal connections, qualify one to ask for land, and it is given on the basis of usufruct. In any case, the council of elders must approve such a transaction. The lands given to a stranger are usually within the territory of the clan. In return, the stranger must show solidarity and allegiance to the clan members. The stranger and his descendants have no right of inheritance; his children can only renew the usufruct right. The length of usufruct is indefinite, and this has led to many misunderstandings by the colonial and current government administration, and still complicates many land cases today.

The *jadak* tradition dates back to the time when a rich man counted his security and prestige by the number of followers he could attract to his holding. Elements of this still can be observed in the Luo 'virtue boasting' custom. It is fair to say that the Luo encouraged *jadak* to settle among them and, until recently, a *jadak* was not normally turned out of the land 'given' to him, except in certain serious situations. According to some informants, the expression *chiam gi wadu* ('eat what you have with your neighbour') is strongly associated with the Luo concept of *jadak*. If, on the other hand, the clan in which a *jadak* was a squatter was at war with another clan, and he had shown bravery on the battlefield, his position was changed to that of landowner. After all, he had

---

<sup>7</sup> According to Luo beliefs, land that was found unoccupied was left as a trap, or smallpox had killed the owners. Such land was tested by advance parties of warriors and diviners.



fought for the land and was prepared to sacrifice his life for it, just in the same way as the ancestor of the present member did.

The distribution of land to *judak* was not meant as an economic enterprise in a direct way, but as a means to achieve higher status. The land was being valued as a source of wealth and as a means of subsistence, which may raise a person into an honorific, higher position. Land distribution was a vehicle for prestige and a means of protection.

#### *Land allocated to slaves*

*Misumba* is the word used to describe a servant or a foundling brought up as a foster child, or a slave in the proper sense of the word (Ochola-Ayayo, 1976: 131). Under the first meaning of *misumba*, a child, or a fully-grown man, is assigned by the homestead head to the house of a *migumba* as if he were her son. A woman is regarded as a *migumba* if she has not had a male child. A *misumba* is then expected to fill the social position of a male child in the house of the *migumba*, as if he were that woman's actual son. In any case, a *misumba* inherits his foster mother's gardens and livestock, but his position with regard to the inheritance of his foster father's field (*mondo*) is like that of an illegitimate child. If the foster mother gives her *misumba* cattle to marry a wife, then he is expected to become a member of the clan, and his children will also be members of this clan. If, however, he should one day decide to return to his original clan land, then not only does he lose the land, but his children and their mother too. The children are regarded as the legal descendants of the social father, or as an informant put it: '*their mother's bride-wealth was clan wealth*'.

#### *The inheritance of land: the customary law*

The system of land allocation by the father while he is still alive is important, since it resembles the system of land inheritance. The principle of the division of land between brothers or sons in a monogamous family is rather simple and straightforward. Land conflicts usually arise between *nyiego* groups. In the case of two or three sons of the same mother, the senior son takes the centre portion of the land in the homestead up to and beyond the gate or to the buffer zone<sup>8</sup>; the other sons then have the remainder of the land to divide among themselves. If the land is divided among the elder sons after they are married, and they take to living on their lands, it often happens that the youngest son remains in the father's compound to care for him in his old age. His inheritance is the last property called *mondo* (father's garden) and the remaining gardens of his mother (see also Wilson, 1961: 13; Ochola-Ayayo, 1976: 129).

---

<sup>8</sup> A buffer zone is open land between family lands. Nowadays, buffer zones no longer exist. They have been allocated to certain homesteads.

In the event of a father's death, then whoever remarries his wife as *jater* is the legal guardian of his fields and his children. A *jater* may take the widow to his own village or he may live in the village of the deceased. The widow will continue to cultivate her dead husband's land. The *jater* may also cultivate these lands on a usufruct basis but must vacate them if ordered to do so when the sons of the deceased have married and established their own homesteads. In most cases, a *jater* is a classificatory father to the children, and he will fulfil his obligations to the latter according to law, but, should a *jater* be a stranger (*Jawagundia*), then it is the duty of the clan elders of the dead man's lineage to watch him closely and to allocate the sons of the deceased their land. The *jater*, whether relative or stranger, has no permanent right whatsoever to any of the dead man's property, nor have the leviratic children (children born of the *jater*), unless there is no male heir. Once the eldest son has built his homestead, it becomes his duty to set up homesteads for his junior brothers. He should divide the land equally; or else the junior brothers may seek redress from the council of elders.

The right of inheritance also depends on the presence of ancestral graves on the land (Shipton, 1992: 377). Furthermore, if the ancestors conquered the land, a descendant can lay extra strong claims to it (Ogot, 1967: 222). Land is inherited only through patrilineal relationships. A sole survivor of the grandfathers would then inherit all the grandfathers' land. A brother only inherits land belonging to a full brother if the latter does not have a male descendant. The eldest of the group of brothers is the temporary owner of the father's entire land, and acts as arbitrator in disputes between the younger brothers. Further redress can be sought from the council of elders. The land belonging to a paternal uncle can only be inherited if he does not leave a son, or full or half-brothers. The principle of inheritance by the nearest agnatic kinsman operates throughout the clan, that is, if no heirs can be found from the father, grandfathers or great-grandfathers, then the nearest male relative to the deceased within his clan inherits. The sons, when they marry, share their mother's land. A mother usually gives her sons part of her garden at that time, but unmarried sons inherit those fields remaining at their mother's death. Fields that belongs to daughters, (that is, the fourth wife) attached to the senior wife, who has no sons eventually go to the sons of the senior wife. The same applies to daughters (that is the fifth wife) attached to the second wife and daughters (the sixth wife) attached to the third wife, and similarly their sons will inherit the senior wife's fields if she has no son. The land given to the attached daughters by the first set of co-wives (first, second and third wives) is regarded as a permanent transfer. If both sets of co-wives have sons, the sons inherit the land in a way described below. If only attached daughters have sons, they inherit all the land belonging to the other co-wives as well.

In the event that a man dies without a male heir, then his land reverts to his father or nearest agnatic kinsman, except that portion allocated to his wife or wives provided they remain within the lineage of the deceased. In the case of a man dying without a son and his wife having been unable to provide a male child through another relationship, she may 'remarry' a girl, usually from her own clan, with the cattle of her dead husband or with her own cattle. She then calls a close agnatic kinsman of her deceased husband to cohabit with this girl to serve as genitor. Children of this union are regarded as the legal sons of the deceased husband, and they will inherit his remaining wealth: land, cattle and other personal properties. This form of marriage is what anthropologists call 'ghost marriage' (Ocholla-Ayayo, 1976: 131).

*Inheritance of land in a polygamous complex*

In the case of a polygamous complex, land is divided along the same lines, except that, within the village, the sons claim the area contiguous to the houses of their mothers. Each wife and her sons are regarded as a group with similar rights to the son of a sole wife: children of the senior wife are given that portion of the total area that would have been given to the senior son in a monogamous family. The sons of the second wife, and the sons of the third wife, lay claim to those portions that would have fallen to the second and third sons, respectively, in a monogamous situation.

There is, however, a further complicating factor and that concerns situations where there are more than three co-wives (perceived as attached daughters). These co-wives are attached to the first three sets. The sons of the senior wife inherit as a group with the sons of daughters attached to the senior wife; sons of daughters attached to the second wife and the sons of daughters attached to the third wife will also inherit as groups with the sons of the second and third wives respectively. The law of inheritance may become confusing if development practitioners from outside or even the insiders do not understand kinship ideology and terminology used to describe the relationships of the persons involved.

**Labour relations**

As stated earlier, Luo people were originally fishermen and pastoralists. Cattle were valued highly. It was a status symbol and it was used for wealth accumulation and for the payment of bride-wealth. Around 1800, when the Luo started to live in *gwenge* (countryside settlements), they took up shifting cultivation, clearing a piece of bush land and using it for a few years as arable land until it is exhausted, and then moving on to clear a new piece of wasteland. It seems that at this time Luo men were getting more involved in agriculture. Encounters with the Abaluhya, a Bantu tribe with a long

agricultural tradition that involved both sexes, presumably had influence on that. The fact that the Luo gradually migrated from dryer savannah-bush lands in the South of Siaya into the wetter highlands of the North of Siaya (Cohen, 1983: 7), that were more suited for crop cultivation, probably also influenced this shift towards arable farming. In the Luo tradition, women's tasks were subsistence agriculture, fetching water and firewood, gathering of vegetables and fruits and cooking. Men were cattle herders, fishermen, hunters and soldiers, who protected their people and cattle against enemies and raiders, and who could practise raiding themselves. They remained hesitant to get involved in crop cultivation. However, with population growth and the decreasing number of cattle, men were more or less forced to take up other agricultural tasks as well, such as land preparation, sowing, weeding and harvesting.

Luo labour relations are subject to power relationships within the homestead and are arranged along the social units of *Jokawuoro* if monogamous and *Jokamiyo* if polygamous. We shall discuss this with regard to some specific agricultural tasks, first sowing, and first harvesting. But first I will briefly elaborate labour relations at a more general level. The first level of labour arrangement is within the *dala* (homestead), where labour for agriculture is mainly supplied by the family. If monogamous, the father, mother and their children will work the fields together as a group. However married sons, whose wives have undergone first liberation, are allocated land of their own to cultivate. Among the Luo, when a man is married, his wife first cooks and eats from his mother-in-law's house. Later she is liberated to cook in her own house and she is allocated land that is meant for her husband. There she cultivates her own crops and the proceeds are for her own house. In a case of shortage, her mother- or father-in-law can give her grain. This first liberation is what is called *theno kendo* in Luo.

If the homestead head is polygamous, labour arrangement follows the *Jokamiyo* principle. Sons and daughters of the same mother work in the fields allocated to their mother. However, this happens only after the *golo kodhi* (first sowing) principle has been observed. The first sowing and first harvesting (*dwoko cham*) principles are based on seniority and leadership and define who does what, where and when. Fathers are able to command the labour of their sons and daughters while still in his homestead. In any homestead among the Luo, it follows that the senior wife is the one to plant first in the homestead head's field (*mondo*). Before others in the homestead can plant or dig, everybody is supposed to work in the *mondo* of the *Jaduong dala*. After the first wife has dug and planted, then everybody can work his or her own land. During peak periods, the homestead head can decide to arrange labour in such away that all members of the homestead can work in every woman's garden in a rotational manner. This way, all the women get access to equal and well distributed

labour thus enabling them to resolve labour bottlenecks. This applies also for the case of harvesting. The senior wife harvests first from the mondo then everybody can embark on general harvesting.

The above case illustrates how practices like *Golo Kodhi* and *Dwoko Cham* reproduce father-son relationships and mother-son relationships and is the way by which fathers can control and command labour from their children. It shows how power is manifested within the *dala*. However when the workload is heavy and labour is short within a homestead, family labour is often supplemented by mutual help arrangements and sometimes hired labour, usually casually employed. Traditionally the Luo had very marked specialisation in their use of family labour. Having been pastoralists the responsibilities of the men were towards the livestock. This carried over into the responsibility for seedbed preparation done, whenever possible, by oxen. The women were responsible for the weeding and harvesting. These traditional specialisations have largely been eroded due to labour shortages at the level of the *dala*, though can still be observed in some individual maize and sorghum fields.

Next to the *dala*, labour may be organised at village level. The village then represents and offers opportunities for a second level of labour arrangements. In the villages where the study was carried out, much mutual help takes the form of small groups, though some can also involve hidden asymmetries and inequalities, even exploitation when the people offering the labour are from your lineage. Among the Luo, a person from the same lineage does not anticipate pay for labour offered to a kinsman with whom he shares the same lineage. This kind of belief has been a point of conflict among lineage members as far as labour is concerned within a village. Luo share work in infinitely varied arrangements, mostly unnamed whereby they negotiate and renegotiate them in flexible patterns that can change from season to season. Some are share cropping arrangements whereby two or more parties pool their inputs (land, labour and seed) and divide the outputs according to some prearranged ratio or formula. When neighbours join forces to combine the ox team of one with the plough of another, or the oxen and plough of one with the labour of another, they define their social identities as people of the same grandfather or lineage as well as commit their economic resources such as the ox-plough and the oxen.

Common too among the Luo is the *rika* (people of the same age), whereby a small group of neighbours, usually of the same sex - and more likely female than male - arrange to work each other's fields at regular intervals, in rotation. Many agricultural tasks are done this way, but most usually weeding which is the most intense and dullest farm operation. The *rika* usually numbers from about three to eight, but some individuals belong to more than one.

Another community labour support is one where larger groups of neighbours and kin meet to work for an individual sponsor in a field. It is known as *Saga*

and takes on a festive and is often mildly competitive in character, and it includes partial compensation in form of food and drinks. Most farmers mentioned that *Saga* has died out due to monetisation. A new form of labour groups that have now taken the place of *saga* are often based on common membership of churches, women groups and youth groups where people meet weekly or at other regular intervals. Such groups often hire themselves out for cash. Poorer women seem to do rather more work in church groups than the richer ones.

All these kinds of communal labour exchanges may be called entrustment or are based on reciprocity. Such arrangements presume that the partner, the group, or society as a whole will eventually compensate the resource contributor in some way. Though in the *Saga*, at least, the compensation may be indirect and not evenly commensurate with one's cumulative efforts.

### **Kinship, culture and the seed**

#### *The Golo Kodhi (first sowing) and the Dwoko Cham (first harvesting) Principles*

With regard to *golo kodhi*, the principle of seniority still applied. According to Luo customs the most senior elder person within a lineage in a village (*Jaduong Gweng*) was the first to start preparing the land and the first to sow in his *mondo*. He was known as *Jagol Pur* or *Jagol Kodhi*. The night before sowing, the village elder would spend the night in the hut of his senior wife. A portion of the seed that was going to be sown was placed in the same hut. The purpose of the ritual was to fertilise the seed and to get blessings from the ancestors. This was to guarantee a good harvest. The next day the eldest wife sows first. Four days after this sowing has taken place, the others can follow. During these four days the village elder spends the nights in the hut of his senior wife. So after four days the different homesteads of which the village is made up of are allowed to start sowing. Within the homestead the ritual applies as for the village. The night before sowing the homestead head spends the night in the hut of his eldest wife with the seeds to be sown.

After the homestead head has sown the rest can follow after four days. What follows after *golo kodhi* was then known as *Chwoyo* (*General sowing*). However weeding is open and free and does not apply to the principle of seniority. Sowing is done according to seniority in a given lineage (*Jokakwaro*- people of the same grandfather). The grand father and his senior wife have to plant first. If such an elder would be a widower his son and his senior wife could carry out this ritual. Alternatively if he is not alive any more then the next senior most person in the lineage takes over. Mostly it was still his first born son. Similarly the senior wife has to harvest first. This is considered as a sign of respect for the elders that you wait with planting and harvesting until they have done it. The practicality of

it was that the elder people were considered to be normally knowledgeable and skilful (resource rich), so very important and useful to the community. If they are not given respect they might not support the community when there is a need for it. The belief system dictated that any member who failed to obey the agricultural ritual procedures or refused to perform them as per their order would implicate a folk punishment, a severe wasting disorder called *chira*. *Chira* if not averted or ritualised in good time, often severely thinned a patient and ultimately killed him. It can only be cured by an *ajuoga* (a diviner), who can provide *manyasi*, a herbal concoction (Parkin, 1978: 149, 155). This means the person would get sick and die of an unknown ailment unless an elderly person (mostly knowledgeable in herbs) is consulted. The elderly people knew the herbs that could cure the disease (antidote). *Jadak* was not allowed to *golo kodhi* first. The elder people were supposed to take the seeds to the farm first and they had to follow the gate.

The other reason to this is that according to his position in the family clan, he is the only one who could be allowed to carry out certain rituals first. This is because in case of crop failure, he is the one who would be approached to conduct certain rituals that will appease the ancestors thus leading to good harvest the next season.

Regarding the seeds for *golo kodhi*, one of the elderly farmers from Nyamninia village stated that originally *golo kodhi* was mainly done using sorghum or finger millet the crops which the Luo came with from Sudan. However, since maize, introduced early in the 20<sup>th</sup> century, became a staple crop, the principle of *golo kodhi* was extended to this crop as well. The seed that was taken to the hut of the eldest wife the night before sowing had to be *koth dala*, i.e. the seed that already was in the family for long. It was lineage seed and could be secured from the lineage in case of shortage. Hybrid maize could not be used for *golo kodhi* ceremony because it was not *koth dala* (family seed). Family seed was carefully selected from the field during harvesting. Hybrid sorghum or hybrid maize seeds can be used only for general sowing. These days, it seems, the principle of *golo kodhi* is more confined to the people living inside a homestead.

Similarly when the crop was mature or ready in the field, the first person to harvest was the eldest wife in the village. This is known as *dwoko cham* (bringing the first harvest back home). The eldest wife will first brew a lot of *Busaa* (local beer made from sorghum and millet) for the *Jodongo* (elders). She would then invite the village elders and her co-wives to come for a feast called *fwachra* or *gwelruok*. This feast was meant to thank and please the ancestors and *Were* (God). The elders will first pour some of the alcohol on the ground to thank their ancestors and God for the good harvest. After this feast, other farmers

could also now perform general harvesting. General harvesting is known as *Keyo*.

During the ceremony, the elders will eat the first harvest before anybody else. Then the rest of the villagers will set on harvesting the next day. During this ceremony, the elders request the senior most elder (*Jaduong gweng*) who is also *Jagol pur/Kodhi* not to delay people during the next planting season. He was to try and plant as early as possible. Failure to do so, he was summoned to appear before a council of elders to answer some questions. Then they heavily fined him. He was then sent away from the land to live as a foreigner (*jadak*) in a foreign land. This does not happen nowadays as everything has been reduced to homesteads and not villages.

In homesteads, if polygamous, then the first wife is the one to harvest first. If she harvest the green maize, she boils it and then consumes it with her co-wives. Then after that, every body in the homestead can now harvest. There are real conflicts when it comes to this. The elder woman if capable i.e. has got elder children and are working in towns who remit money back to her at home, will not just be in a hurry to sow first or harvest first. The other wives will have to wait whatever the case.

The ideology behind *golo kodhi* and *dwoko cham* practices is based on gate making. When a man establishes his own homestead, there are certain rituals that are carried out. In establishing a new compound, a man does it with his eldest wife and his eldest son. The son carries an axe and a cock, which symbolises defence and the eldest wife carries the fruit of sodom apple (*Solanum incunam*) symbolising fertility. After some times a gate is made (*Dolo wakach*). Gate making is a complex and elaborate process that involves the assistance of a diviner who administers *Manyasi* (an herbal concoction). During this time, two posts are put at the gate and one is crossed over them. The sons and the eldest wife must be present at the gate. The elders then cut a cock, which is hanged on the crossed post of the gate. The blood drips downwards directly at the centre of the gate. Fire is lit at the gate, and this cock is roasted at the gate. The first wife brings *ugali* that is then eaten with the roasted cock. Then some herbal concoction (*Manyasi*) is given to all the sons and the owner of the compound to unite them and for them to observe the covenant they have made with their ancestors. The eldest wife also takes this charm. Other women were not to participate in this ceremony of gate making. Then in the middle of the gate where the blood was dripping, *Manyasi* in a container is buried. During this process a covenant was made between the ancestors and members of that home.

The gate of the *dala* has a very sacred meaning. It is unthinkable that (after this ritual) younger persons in the *dala* would go out with seeds to sow before



the *Jaduong dala* and his eldest wife have done so. It is because of all these that one is not supposed to violate the two ceremonies of *golo kodhi* and *dwoko Cham*.

### **Land inheritance, labour relations and agricultural practices in reality**

Let us now examine how the kinship and land inheritance ideology works out in every life. Issues of land allocation and inheritance have become much more conflictive and complex as land has become scarce with an increased population. The room for manoeuvre for allocating and dividing land according to Luo customs among clan members, or for allocating land in usufruct to strangers and slaves, has been substantially limited over the years. Furthermore, Luo land-tenure arrangements were partly destabilised or disrupted following the implementation of the Swynnerton Plan from the mid-1950s onwards. This plan laid the political groundwork for a state policy to privatise land tenure in Kenya (Hebinck, 1990: 59). A programme was launched to adjudicate and register all the land, and subsequently, title deeds were issued. This opened doors to the buying and selling of land. However, private land tenure has continued to operate concurrently with Luo customary law whereby Luo elders still quell land disputes among their people. Where there is no conflict over land, people have been able to buy and sell land on an individual basis. *Jadak* and *misumba* have been able in this way to get land as long as they could afford to buy it from a willing seller. As we shall see in the cases presented below, the legal and written evidence that a piece of land belongs to a certain person has stirred intra-lineage and intra-household conflicts. Privatisation of land represented a breakaway from the past when land was, more or less, owned collectively by the lineage under the authority of its leaders. In the past, Luo elders would act as judges in the case of land disputes and settle them. This role is now increasingly taken over by government magistrates' courts and district land tribunals.

In the research villages of this study, labour is a bottleneck. Farm labour arrangements there take two forms. The first is non-commoditised labour, which comes from the family itself and exchange labour mobilised through different relations. The second form is commoditised labour i.e. wage labour. In these villages, farm labour is mainly supplied by the family supplemented by hired labour, usually casually employed at periods when the workload is heavy.

However, nowadays it is very difficult to get labour in the four villages. Adult sons and daughters refuse to work on the farm as they equate farming with failure in life. No amount of pressure on them will make them do farm work. Some seek refuge in town even if there are no jobs there. They live there for a short period and come back home for another short period when labour demand is off peak. These shifts have made them unsettled. Yet they continue

depending on their older parents. The result is the break down of family labour. But our findings show that this migration to urban centres is now dropping because of the lack of employment in town.

Farmers who were asked about the *golo kodhi* ceremony did not always agree upon its exact implications. Some stated it applies to the lineage only. Others stated it applies to a whole village, a younger person should wait for an elder to sow, even if this elder is not a relative. These differences are to be expected. Culture is not a static phenomenon but the outcome of ongoing negotiations.

The cases presented below aim to elaborate on such differences and negotiations. They were chosen so as to represent the various ways by which land may be customarily inherited and allocated. As the cases also show, at local level, customary and private land tenure systems clash and become entangled with day-to-day problems. The cases help to illuminate the problems that exist in labour relations in the research villages and through them I explore the negotiations and renegotiations among farmers that form the centre play of cultural practices like *golo kodhi* and *dwoko cham*.

#### Case 1

The situation of Oketch Bundmawi and Oduor Lomo (see Figure 2) illuminates the complex nature of land quarrels and inheritance. They are brothers and have the same father, Ogonji. Despite Luo customary law, neither has yet managed to inherit land from their father. Their elder brother, Abednego, currently holds all the title deeds of the land of their grandfather, Olum. Oketch for the moment cultivates the land of his deceased uncle, Agina, where he has also established his own homestead. Lomo, as the youngest son of Ogonji, should have inherited the plot (*mondo*) and the homestead of his father, Ogonji. However, Abednego cultivates the largest portion of his father's land and he has also established his homestead on his father's *mondo*, thus dashing Lomo's hopes of inheriting the *mondo*. Another portion of the land is still retained by their mother. It should, according to Luo customary law, go to Lomo after her death. Lomo currently works on another part of his mother's field and a small portion of the land of his paternal uncle, Odongo.

To fully explore the many dimensions of this particular conflict we need to go back to the brothers' grandfather, Olum. The origin of the conflict can be partly traced back to him and his eighth wife, Adungairo, who was a seer and a witch doctor. Olum had three sons from his seventh wife: Ogonji, Agina and Odongo. Odongo is the only son still alive and he has a hearing problem due to his old age and does not say much about his father. When asked about his father Olum, the grandson, Abednego, mentioned that he was a well-known farmer who had come to Muhanda at more or less the same time as the British. He had six other wives in his original village some ten kilometres from Muhanda. Olum's family

also belongs to a lineage of the 'real' landowners, the Gem people who conquered Muhanda village (from the Abaluhya) before the establishment of colonial rule.

Olum came to Muhanda with his seventh wife who died in 1934, after which he married Adungairo. This marriage produced no children. It is believed that she was possessed with evil spirits who did not allow her to have children, but because she had healing powers she made Olum rich, as people brought her many cattle and goats. At the time of his death, he was a famous and a wealthy person.<sup>9</sup> It is believed that Adungairo bewitched Olum's sons, as all three experienced marriage problems.

To escape witchcraft, they went to the Rift Valley to find work on white settler farms. Odongo did not stay long and came back home almost immediately after his father's death to settle into farming. He got married and had a daughter. His wife died soon after that and he never remarried. Agina married in town and did not return to the village. He died in town and his wife did not live long afterwards. Their son, Okumu, is now a high-ranking railway functionary in Nairobi. He married in Nairobi and never visits his father's village.

Ogonji was Olum's first-born son and when Olum died, Ogonji was working in Kitale as a mechanic for the Hughes Company. He married and had three sons, Abednego Ochieng, Oketch Bundmawi, Oduor Lomo and a daughter. The daughter is married and lives in Seme. Since Ogonji married rather late, he fathered his children when he was at an advanced age. He retired in 1970, returned home, and died in 1979.

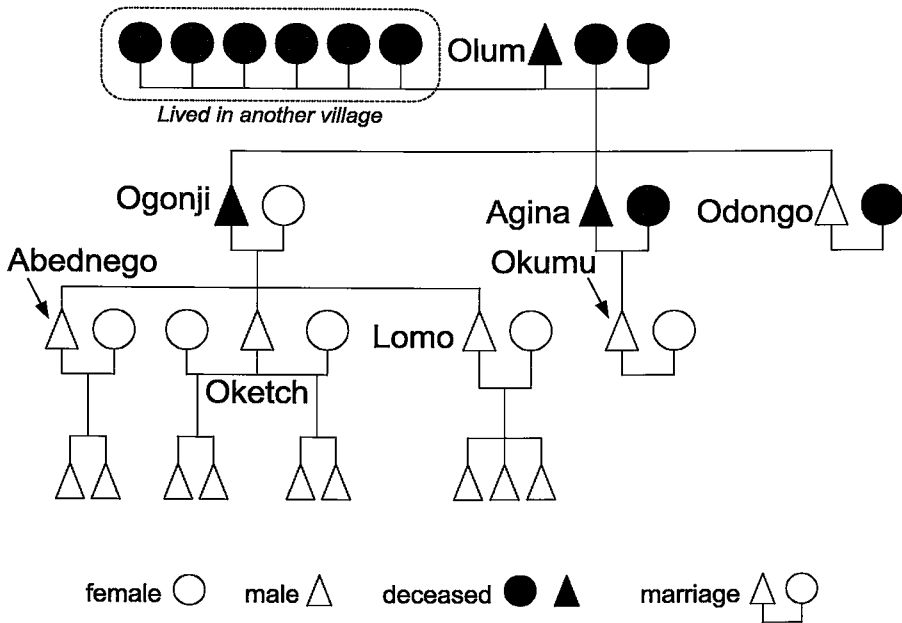
The land tenure arrangement in the Ogonji family is that of people descended from the same grandfather (*jokakwaro*). When Olum died, he had allocated land to his three sons. The records of the District Land Register in Siaya indeed specify that the title of plot no. MN 426 (7.5 acres) is vested in Ogonji, that of plot no. MN 423 (6.5 acres) is vested in Agina, and plot no. MN 424 (5.5 acres) is registered in Odongo's name.

Abednego, being Ogonji's eldest son, customarily holds the title deeds for all three plots. This is because the last surviving son of Olum, his uncle Odongo, is now old, has no heirs and is depending on Abednego and his wife for his daily subsistence. Odongo officially has a say over all the title deeds, but has given them to Abednego for safekeeping. To complicate things even further, Abednego is also cultivating his father, Ogonji's plot (*mondo*). Oketch and Lomo are not happy with this situation at all. They feel that they should get their share. One day when the issue came up, Odongo made clear to them that

---

<sup>9</sup> After Olum's death, Adungairo left and remarried somewhere else. Her wealth followed her. In Luo land it is believed that when a rich person dies or leaves an area, whatever wealth he or she leaves behind disintegrates.

*'you can subdivide your father's plot among yourselves. I will retain Agina's plot because he was my brother and I will also retain mine. Furthermore I can still marry and get a boy child who can be heir to my plot'.*



**Figure 2: The descendants of Olum**

This scared Ogonji's three sons. Their mother advised them to suspend their quarrel for the time being. They fear they might lose these plots – the more so, because Odongo has the right to sell his own and Agina's plots. So they do not want to annoy him in case they lose the land.

The reason why Abednego is holding on to the title deeds and not allocating them to his younger brothers is a combination of how authority is exercised and of not complying with expected patterns of behaviour, such as mutual help in return for assistance later. When Ogonji died, Abednego shouldered his responsibility as senior brother and paid for his younger brothers' education up to secondary school level. Furthermore, he says, *'I paid bride-wealth for my brother Oketch when he married'*. When they later got jobs, he demanded assistance from them to help him pay school fees for his children. Both refused to help him out.

Abednego is not happy with them, given that he expended resources on them that he could have used to improve himself.

On the other hand, Lomo and Oketch argue that they do not like the way Abednego exercised his authority as the senior brother. When they returned home from working in town, neither had yet established his own homestead. Abednego made them eat in his house, while their wives were made to eat in their mother-in-law's house. Abednego's objective clearly was to draw labour from his younger brothers and to make them work in his fields; but, when the harvest was brought in, he barely shared it with his brothers. Abednego defends himself by arguing that he was using his position as eldest brother to unite the family. Lomo was not happy with the situation and liberated himself unofficially in 1994, when he ordered his wife to start cooking in her own house. Lomo thus violated the Luo custom of seniority. Being the last born, he should have been the last one to be liberated. Oketch also followed with his wife. Lomo then requested to be given his own plot so that he could engage in serious farming without being controlled by Abednego, but his mother refused. She told him outright that Abednego is everything in their family. Lomo is only allowed to farm part of his father's land and his uncle Odongo's land temporarily.

The conflict, as it now stands, partly involves people of the same father (*jokawuoro*) but has the potential of also involving people of the same grandfather (*jokakwaro*). Okumu, who could claim the land of his father, Agina, will not be a serious contender however. Oketch, who now lives and works on Agina's land, is convinced of this:

*'My cousin is a very irresponsible man. When my uncle Agina grew very old, he did not take care of him. When he died, he did not even come home to bury him. When his own mother died, he never came back home. This means he delinked himself from us. We can only give him a small portion of this plot.'*

The situation will become more complex if the descendants of Olum still in his original village show up and claim the land. Customarily, they are entitled to claim the land of Agina and Odongo, as it is part of the land belonging to Olum, their father.

With regard to labour arrangement in the Ogonji family, when Abednego started farming in 1972 after secondary school, he relied mainly on family labour. He was not married then. He worked in his fathers' fields with his mother and his two brothers, Oketch and Lomo. Since he was interested in growing hybrid maize and to practice modern farming, he won the favour of Ministry of Agriculture extension officials and KARI research officers. This way he got his fields prepared for him in good time as he could access the tractor for free. He secured money for weeding his crops from KARI research officials, as his plots were on-farm research trial plots and for demonstrations. During those days, Abednego says that life was easy. In the 1970s and a big part of 1980s, he

used a tractor on his farm. However, since the government tractor hire services were run down through a lack of maintenance and repairs, he no longer uses them. During those times he practised large-scale farming accompanied by high input use as he could get them from the government free. He could hire wage labour from sales of his proceeds.

*'I could hire labour for slashing, and clearing the land. If I failed to get a tractor in good time, I would hire labour for ploughing as well. I did not use ox-plough on my farm then because I feared the oxen could bring ticks on the farm that could attack my dairy animals. I weeded twice and top-dressed the maize after weeding using nitrogenous fertiliser. I used wage labour as well during the weeding period. I preferred working with people from afar. People from around here demand a lot of money and when you pay them they disappear without working. The parents of most young men here also prefer their children not to work for you as you might think that they are unable. I find it almost impossible to hire labour from the local people around. During the past ten years the acreage I reserve for maize has decreased. This is because I can no longer hire a tractor from the government. These tractors are no longer there and I do not have capital to hire people for wages.'*

In the period 1993 and 1994, Abednego had problems with his two younger brothers as far as labour arrangements were concerned. Abednego had educated his two brothers up to secondary level and they both moved to town to seek off farm employment. Lomo was very lucky and was employed by Motor Vehicle Assemblies in Thika town. Oketch was not always lucky. He could only get casual employment in factories that lasted for a fortnight before he was laid off. So he came back home to join his eldest brother on the farm.

In 1993, there was a general lay off of workers in the company where Lomo worked. When he came back home, he decided to join his two brothers in serious farming. In that year Abednego and Oketch were still at their fathers' compound. All three brothers were now married. Abednego's wife had been liberated to cook from her own house but Lomo's and Oketch's wives still had to cook and eat at their mother in-law's house. Abednego made his two brothers to eat from his house. This was a strategy to get labour from them in return. However Oketch and Lomo rebelled. That same year, Abednego was liberated for the second time and established his own homestead, a process known as *goyo ligala*. This meant he could no longer draw labour from Oketch and Lomo as he had become fully independent.

Since 1994, Lomo has worked alone on his farm, with his wife. Labour is thus a constraint and he uses no hired labour. His children are still too young to work on the farm. Oketch the second brother has since obtained a job as an assistant chief and is able to hire labour. He has also been liberated for the second time and has established his homestead on Agina's plot. He has married a second wife who according to Oketch adds to his family labour.

When I visited Abednego during the short rainy season of 1996, he had grown less than a half acre of maize since he had labour problems and his eldest son was still in school. During that time, he and his wife were the main source of labour. His sons and daughters worked on the farm only over the weekend and during school holidays.

*'Labour is the main problem I am facing in this farm. With lack of capital to hire labour, I rely on family labour. This has affected my farming a lot. I would like to increase the acreage of my farm but I cannot due to labour shortage'.*

Labour shortage on his farm reminds him of traditional labour arrangement that were very effective but eroded by urban migration and monetisation of labour.

*'Saga (Community labour support) was so popular. During such occasions as land preparations, weeding, harvesting or putting up a new house. Saga was so valued that even passers-by noticed that somebody had organised saga they would call in and lend a hand. It was unusual for a villager to refuse when approached to lend a hand in Saga without a genuine excuse. People known to be uncooperative about others' saga found themselves without adequate support during theirs. Thus, saga operated on the principle of reciprocity. Always, there was 'food-for-work'.*

In 1998, his son Odok had completed school and they were now again reviving the farm. Odok like his father works hard on the farm. His second son Raduk, dropped out of school at primary level, had earlier migrated to town to seek off-farm employment but returned home after failing to secure a steady job in town and has taken up one of his father's plots as his. He does not like working with his parents.

Raduk does not give his parents the proceeds from his farm. He sells them and uses the money to buy his own things. In 1999, Odok decided to desert his father and go look for a job in town. He became a taxi tout but the job proved uninteresting and he came back home. But this time round he has never wanted to work on the farm. He joined the Outreach Mission Church and got 'saved'. Some days in the week he had to fast and go to prayers. Later he got a job on the Yala Town Council as a casual labourer and now lives in Yala. His father does not approve of the job since he earns very little from it. He is trying to convince him to come back to the farm so that they can work together. Abednego finally admitted that he requires labour from outside though he would prefer family labour.

Abednego laments that labour problems in his village have been aggravated by the kind of education that is being offered to the youths and by the HIV/AIDS scourge. The education offered to the youth is not suitable.

*'A syllabus that is suitable to our region should be developed as non-educationists developed the current syllabus. They do not understand the workload of the teachers. Pupils have to go to school even over the weekends when they are supposed to help their parents in order for the*

*teachers to complete the syllabus. Education is not balanced. It has no connection with the needs of the people'.*

The HIV/AIDS scourge has robbed Luo society of many of its able-bodied members. In the research villages, people bury their kinsmen every weekend. The HIV/AIDS rate in Siaya is very high. Abednego cites the case of Ochieng Monye who was a young dynamic farmer in Muhanda village and died of AIDS. It is a big blow to his father who is a widower.

In 1999, the Catholic Church, to which Abednego belongs, started an ox-traction project for its congregation. Nobody was willing to rear and train the four oxen for ploughing. Abednego saw an opportunity here and offered himself as guardian to the oxen and took them. The church then gave him an ox-plough and appointed some personnel to work with him. The Belgian Government through the Catholic Diocese of Kisumu supports the project. They plough for the Catholics at reduced cost. Abednego's fields are ploughed for free. He also gets paid for taking care of the animals. By February, 2000, he had ploughed a very large parcel of his land and planted maize. By the end of the research, Abednego was anticipating a bumper harvest. Since his two brothers belong to the Anglican Church (they joined the church of their wives according to him, which he considers inappropriate) they are not eligible for the traction project. Nevertheless he will try to get them enrolled in the project in some other way.

Abednego claims that he does not believe that the principles of first sowing and harvesting can harm anybody and he observes them. In response to a question on the current influence of *golo kodhi*, Abednego stated that few people nowadays follow this practice. Instead most farmers follow the 'better' farmers example. Abednego defines better farmers as farmers who use modern technology and who embark on path breaking initiatives to bring modern technology to areas such as Siaya. He regards himself as a better farmer. Better farmers are, or should be informed by government officials when maize should be sown. The other farmers can then follow immediately. It is of great importance that farmers sow at the same time since otherwise farmers who plant early would have their crops damaged by pest (birds would eat their grain).

However, Abednego believes that *golo kodhi* is a useful tool for making youngsters obey the elders and keeping them in line. This restrains them from just harvesting the family plots and consuming the food without consulting the elders. Therefore, *golo kodhi* still has a function. In the old days *golo kodhi* would apply to a whole village. Nowadays it is confined to the homesteads.

Abednego's brothers should not plant before their mother and also not before Abednego himself. Abednego now has his own compound. His brothers should



co-operate. They should not plant earlier because Abednego's children might steal their maize. *'When someone beats your children you will not like him the most. Even if I pretend I like them my wife cannot get along with them because of that'*.

His brother Lomo, who was also present, said that in the old days people would give sacrifices to please God. They were rewarded. Today people pray. They are also rewarded. Lomo believes that when he really prays, hailstones will not hit his garden. He believes that God gave people different ways to communicate with him and all these ways are good. *'As long as you are a devoted believer God will reward and support you'*, he added.

Lomo and Abednego argue that *golo kodhi* is never really a problem when relations within a home are good. For example, Abednego used to help his mother in preparing the land. She could then sow on time, after which he could also set out to sow. At the time of harvesting it was again the same. Abednego would assist his mother and could then harvest himself. However, according to some of my informants, one day in 1996 Lomo had a dispute with his brother Abednego Ochieng over the issue of *golo kodhi*. Lomo assumed that since Abednego already had his own homestead, he had no business directing them in their father's compound and he went ahead and started carrying out research with CARE-Kenya research officials without waiting for their mother to sow first. This brought a big rift and the elders fined Lomo.

One of my informants told me that the research was discontinued on the plot Lomo was working, and Oketch, who was playing things safe, then took over the research. This was how he became an adaptive research farmer with CARE-Kenya, and that CARE-Kenya later recommended him as an 'assistant chief', his current job. Lomo is not happy with this because he would now have been a 'chief'. The case illustrates how violating the seniority within a lineage can bring problems to a young and dynamic farmer.

This first case has shown that land inheritance was clouded by relationships between members of the same kin group or family. This particular conflict is not necessarily about customary land law, but actors use elements of that law strategically to position themselves in the conflict. Furthermore, the case demonstrates that customary law of governance based on seniority can impede one's development. Being a senior person in the family means taking responsibility. There is a kin obligations to junior brothers to pay for their education, bride-wealth, helping organise their marriage etc. Accordingly, junior brothers are also expected to reciprocate in time of need. This order is now being contested. Oketch and Lomo refusing to help Abednego pay school fees for his children have demonstrated this. More significant is that the traditional method of working with family labour has become trickier and parents can no longer even be assured of labour from their own sons.

## Case 2

This case is about Martin and his struggle for land. It involves genealogically the Ogonda (I) family, who is descended from a *jadak* (stranger). The case is further compounded by the fact that the son of Ogonda (I), Obudho, had several wives, and this stirred rivalry when it came to land allocation. As a result, one of Obudho's sons, who was working in Uganda at the time, lost out on land and remained landless until he died. The problem at the moment is that his remaining three sons, among them Martin, are also landless. Martin only has access to the land he is working by virtue of being 'people of the same grandfather'. His other two brothers have migrated to town to seek casual employment. Martin and his brothers are seen as squatters and have no right to title deeds. Their future will be based on their ability to acquire land through purchase.

The Ogonda (I) family live in Luero village. Ogonda (I) founded this village a long time after the region had been conquered by the Luo. However they had never occupied the place. Before Ogonda (I)'s arrival, Luero had been used as grazing land for livestock. This pastureland was allocated to Ogonda (I) in the *jadak* relationship by his sister's husband, who belonged to the Kalanyo clan. Ogonda (I) belonged to the Kathomo clan. One of Ogonda's sons was Obudho, who married nine wives. His sixth wife, Abigail, had two sons, Jeconia Ogonda (II), and John Ambajo. Ogonda (II) had two wives. The first wife gave birth to two sons of whom Martin is the eldest. The second wife also had two sons.

Ogonda (II), Martin's father, on completing his primary education, found work at Mulago National Hospital in Uganda. His wife died in 1965 when Martin was eight years old. While in Uganda, Ogonda (II) married a second wife who is now a tailor in Kakamega. Ogonda (II) came back to Kenya in 1971 on a transfer to work in the Kenyatta National Hospital in Nairobi.

Martin does not have land himself, only access to his uncle's (John Ambajo) land. When the land was subdivided, his father was in Uganda. Since his grandfather had many wives, there was stiff competition for land because of the *nyiego* (rivalry) relationships between the co-wives. As a result, his father was not allocated land simply because, when he was summoned to come back for the land allocation, he never turned up. His step-uncle, Adero (son to Obudho's first wife, Okwatch, Abigail's sister), allocated the land to his paternal uncle, John Ambajo. This is the land on which Martin is living at the moment and which also contains Obudho's second homestead. Most of Martin's step-grandmothers' graves are in that homestead, as well as that of his father and mother. John Ambajo, whose name is registered on that land (plot no. L723 at the District Land Registrar's office in Siaya), lives in Nairobi and rarely visits the village. He is separated from his wife, and his two sons still live with their mother. Martin lives in his grandfather's homestead. His father, however, never



The complexity is heightened by the fact that, customarily, Martin has the right to use the land of his grandfather because his grandmother is still alive and he has the right to use her gardens. Furthermore, the homestead where they are living contains the graves of his mother and father. The migration of Ambajo to town with his sons has enabled him to cultivate part of Ambajo's land, but only under usufruct conditions.

This second case of Martin is quite clear, as each party understands its obligations. The two operating land tenure arrangements do not interfere with each other. Customarily, Martin has the right to be on his uncle's land, but his identity as a stranger confines him to just that and he will never be able to acquire more land. His dreams of becoming a farmer and investing in perennial crops and soil fertility management will only materialise if he is able to acquire land privately.

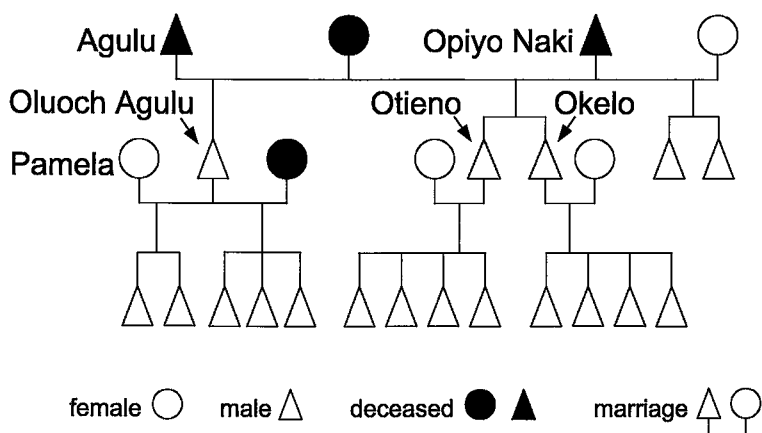
### Case 3

This case also involves a *jadak*, Opiyo Naki, who came to live in Muhoho village among his maternal uncles. The conflict here discussed involves brothers from the same mother. The appellant is the biological son and the defendant is a social son.

Opiyo belonged to the Isuha clan and came to Muhoho as a *jadak*. He had two wives. The first had two sons: Okelo Naki and Otieno Naki. The second had two sons and also two daughters. Opiyo lived from 1890 to 1939. Before his death, he had allocated parcels of land to both his wives and according to Luo land tenure arrangements, the sons were to inherit their mother's land. However, after Opiyo's death, his eldest wife, as was custom, was married to one of his relatives (*jater*), Agulu. Agulu and he shared the same grandfather but had different fathers. He came to Muhoho only to inherit Opiyo's wife. He then left her in Muhoho and returned to his own village some 60 kilometres from Muhoho. Opiyo's eldest wife produced a son with this man. According to Luo custom, the son, Oluoch Agulu, is the bonafide son of Opiyo, rather than of the man who remarried his mother (*jater*). He still lives in Muhoho like his brothers, though their mother, Opiyo's first wife, is now dead.

Oluoch Agulu, born in 1945, has no land of his own. They are *jadak*, strangers in Muhoho and thus were not allocated a large piece of land. His brothers, Okelo and Otieno, tried their best and assisted in his education up to college level. He graduated as a primary school teacher in 1966. He married two wives. He had three sons and two daughters with the first wife. However, they were not happily married and were divorced. He then married the second wife, Pamela, with whom he has two sons and one daughter. Oluoch was still a primary school teacher at the time of research.

When I visited him for the first time, we wandered over the plots he was farming. This did not please Otieno. One day, Otieno met me alone and started



**Figure 4: the descendants of Opiyo Naki**

quarrelling about why I had been trespassing on his field without his knowledge. He obviously did not think his brother had rights to the land. When we checked the land register in Siaya town, only the names of Oluoch's two brothers and their stepmother, Opiyo's second wife were registered as owners. Plot no. MH 734 is in the name of Okelo (Naki's eldest son) and plot no. MH 736 is in the name of Otieno Naki. The plot covers Oluoch's homestead and the fields he cultivates. Plot no. MH 735 is registered in the name of the stepmother. Earlier on, another informant mentioned to us, however, that Oluoch is not a real son to Opiyo, even though he had established his homestead on Opiyo's *mondo*. We were told that he did this on his mother's instructions. Throughout our conversations with Oluoch and his wife Pamela, they did not mention the biological father. In any case, Oluoch now calls himself Charles Oluoch Agulu Naki, which is in fact a combination of the names of his biological and social father.

In 1995, Otieno took this case to the council of elders of Muhoho village and some elders from their original village. The case was decided in favour of Oluoch. Based on Luo customary law, he is the son of the deceased. The ruling did not convince Otieno, and he decided to take the case to the High Court of Kenya in Kisumu. The case underwent several hearings and was still pending in court by the end of the research, following the death of the magistrate who

was handling it. A new magistrate now has to take it up. Most villagers who know of the case argue that Otieno cannot win because Oluoch is his brother.

This case shows the complications that arise out of confrontations between *jadak*-based land allocations and private land tenure arrangements. According to customary law, Oluoch Agulu has a rightful claim on the land because he is a son to his father. Otieno, for his part, is resorting to private land tenure arrangements to secure his case and hopes that the court will rule in his favour. He is clearly trying to bypass customary law. Meanwhile, because of this land issue and some other family-related problems, Oluoch Agulu and Pamela became active members of the Anglican Church and claim to live according to Christian norms and values. Pamela one day made the following remark: *'somehow I get peace in salvation. Christianity is my strength'*.

Because they depict themselves as 'saved' Christians, they state that they do not believe in *golo kodhi* and the principles that are attached to it. In fact Oluoch regards it as a practice that limits agricultural development in the region. That is why they are trying to kill it. Spreading Christianity is the best way of doing this. Therefore, Oluoch also does not believe that one might get *chira* (wrath of the ancestors) if the principle of *golo kodhi* is violated. In Oluoch's home it does not matter who plants first. He refers to his wife as the farm manager.

The Anglican Church to which Oluoch belongs also has some practices that relate to maize management. For instance *lemo mar buru* (taking seeds to the church for prayers). They will go to the church before sowing. Oluoch will never sow before he goes to the church to pray. *"This is a necessity to get God's blessing for your agricultural work. For example, one should not expect rain on ones garden if he does not go to church to pray"*. Oluoch does not concur with households who do not pray before they sow. He feels they are the ones responsible for wide spread famine. Oluoch does not take his seeds to the church for *lemo mar buru*. He feels God is everywhere, so he can also bless the seeds when they are still on the farm. He does not approve of those who do this.

However after every harvest he takes about 10% of the maize to the church.

*'If you do that God will reward you abundantly. The reason for the agricultural crisis in Luoland is that people do not give their 10% to the church anymore. It is not a case of chira that people believe in. The Luo custom was that after harvest, beer was brewed out of the maize and part of this beer was poured on the soil for the ancestors. This custom is also fading and that is why some people think the agricultural crisis is caused by the dissatisfaction of the ancestors (Chira). But customs and drinking alcohol are prohibited for Protestants'*.

According to him awareness of how to marry the cultural farming practices of the Luo and modern farming methods have not been created. He also reasons that neglecting to give 10% of their harvest to the church has inflicted a curse on the farms. He believes that if you offer your harvest to God then he will bless

you abundantly. But this does not apply to farm produce only but also to money. If you have money you can give 10% to the church.<sup>10</sup> People are facing a vicious circle of famine. Traditionally 10% of the harvest was brewed and beer drunk (a feasting ceremony known as *Fwachra* or *Gwelruok*). The case shows where Luo culture is being transformed into Christian practices. Instead of *golo kodhi* we now have *Lemo mar buru*,<sup>11</sup> and instead of the feasting where beer had to be poured on the ground for the ancestors, we take 10% of the harvest or income to the church.

This third case shows the confusion that arises with customary and private land tenure arrangements. Each party in the conflict reverts to the tenure arrangement that fits their particular interest, and engages in strategic positioning. It is such cases that create the conflicts and confusions about land and inheritance with which Kenya as a nation, with its recent politically and ethnically induced land conflicts, is grappling. In the absence of an integrated land policy, the unresolved issue of land tenure persists. More so, many farmers in the same position as Oluoch Agulu tend to embrace what one might call 'modernity' by incorporating all its values and virtues in their life styles. The first step is to discard the Luo customs and embracing Christianity and to some extent getting 'saved' seems to provide an alternative.

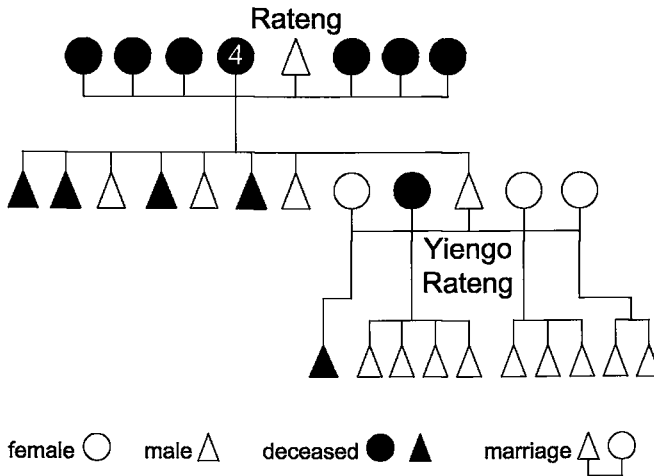
#### Case 4

This case involves a descendant of a slave. It is an odd case in that there is no real conflict as such. Instead it involves a violation of Luo customary law. It involves a descendant of a slave who decided to violate the Luo customary laws in order to improve himself. First he decided to step out of his own family cycle, and then to step out of the Luo norms of seniority and inheritance.

Rateng is the descendant of a slave and lived in Muhanda village. His great-grandfather was captured in the war between the Kalenjin and Luo just before the *Pax Britannica*. The Rateng family has now formed a clan of their own among the Gem people of Siaya. Their great-grandfather 'lost' his own and became Luo speaking. They are now considered as Luo and because they fought alongside the Luo against the Abaluhya, they are now seen as landowners. They are assimilated into the Luo and few people would know they are not Luo, despite the fact that they are taller and darker than the Luo. Also behaviour wise, they believe that anybody from their clan must smoke *bhang* and keep livestock. According to one of our informants, who knows them

<sup>10</sup> See the book of Deuteronomy 26:1-15 of the Holy Bible.

<sup>11</sup> *Lemo mar buru*. A month before sowing people go to church to pray for a good season. *Lemo* means praying in Luo language and *buru* stands for ashes. The reason this word is used in this respect is that dusting seed with ash from burnt wood, sedges or dry cattle dung is a way of preserving seed put aside for sowing.



**Figure 5: Descendants of Rateng**

well, the Rateng family still has a very strong attachment to livestock like their kinsmen, the Kalenjin.

Rateng had seven wives and many children. His fourth wife Briggita had eight sons, the last of whom was Yiengo Rateng (born in 1951). He went to school thanks to the efforts of his mother. His father never wanted him to go to school but to herd cattle. After standard eight he went to Uganda to work in a textile factory until 1976. He saved enough money to come back and establish a welding workshop in Yala, a town six kilometres from Muhanda village. He has four wives and 20 children. His second wife died in 1997. From the returns of his welding workshop, he saved money and bought several parcels of land in different villages, including Yala town. He built three homesteads on these parcels of land without following Luo customs. He moved out of his father's homestead without following any seniority order as required and established his own first home in Nyamninia village. Yiengo argues that,

*'to achieve quick progress, you must move out of your family circle early. Otherwise you will be tied down with unnecessary customs that will impede your progress. I am the last born son in my mother's house and there are also other sons to other senior mothers who are older than I am, I cannot wait for them to do their things first before I have to do mine. For example, when I wanted to plant on my farm, I had to wait for my father and some other people to plant first. I had to leave and establish my own home. If I want to grow hybrid maize, I need to plant in time and I cannot wait for others. People warned me of Chira. So far nothing has happened to me'.*



As he did not inherit a plot from his father since there were many brothers, buying land was his only option. Any of his remaining wives can be asked to live in any of the homesteads he built at any time. He moves between them. For other people, it is difficult to know which of his three wives owns what homestead. This again is something contrary to Luo customs. The youths who do not know the history of Rateng's people, wonder what is going on. But the elders, they know the man is not a Luo and, more so, that his real people still stick to a pastoral life, so *Chira* cannot harm him.

The case clearly reflects the process of individualisation with regards to customs. Yiengo perceives elements of the Luo customs, notably the *Golo kodhi* or seniority principle, as stifling his own way of life and efforts to improve himself, and in general impeding farming in the region. He ignores these Luo customs and understands the identity that being the descendant of a slave can give him. He states:

*'Nowadays the elders are using culture to punish the younger generation who fail to do what they want. In the old days the Jaduong gweng would plant even in January so as not to impede others. At that time people lived together, and would be approached and told off, even elders. Now individualism has come up. People do not accept being told off anymore. So no corrections take place these days. If we cannot change culture with time we will remain with these problems. Today people with status/power use this power to impede the younger generation'.*

According to Yiengo, he does not want his farming to be impeded by such practices. Luo culture to him is repugnant and hampers the adoption of new farming practises. He gave the example of hybrid maize and its time of planting.

*'For instance, hybrid maize seeds should be planted within the first three weeks after the onset of rains. Otherwise you will lose yield. But suppose that the Jaduong gweng or Jaduong dala is not present, then planting is delayed. This is not fair to the young farmers. Private initiative is then not stimulated by Luo culture. This means that the Jaduong gweng or Jaduong dala remains responsible for the farm management on behalf of the entire village'.*

But some village farmers whom I questioned about Yiengo's farming practices told me that I should not use him as an example. He could not give an accurate picture of their practices because he was not one of them.

*'But he is a descendant of a slave. His grandfather was a "Misumba" and he cannot talk for us. We are the real owners of this place. He does not have the right even to live here. Money has spoiled everything. Because he has money, he can do what he wants with himself'.*

Yiengo Rateng does not like hiring labour from the Abaluhya clan of Luanda, Bunyore. He claims they have the skills to make rain and should you fail to pay them their dues, they might send rain with hailstones to hit the Muhanda area. This could destroy the crops before they were ready for harvesting. Yiengo is a farmer who partly believes in the culture but at the same time is always quick

to deny customs that impede agriculture. His belief shifts with the time of the day.

This case represents a situation where Luo customs are not only contested but violated. Like many people in Luoland who are business minded, Yiengo Rateng believes that to achieve development early, you have to move outside the family circle in order not to be tied down by Luo customs. Like other returned migrants, he bought land in various places of his own and neighbouring villages and thanks to the Swynnerton plan of 1953, the law now allows for privatisation of land. As a result, descendants of *Misumba* like Yiengo Rateng, and of *Jadak*, can nowadays own land through purchase. With sufficient purchasing power, they can own even larger parcels of land than the 'real' owners of the land. Any body in the village can now buy land as long as the village elders give their approval that such a transaction is clean and can not lead to conflicts. Situations of this kind are nowadays very common in Luoland.

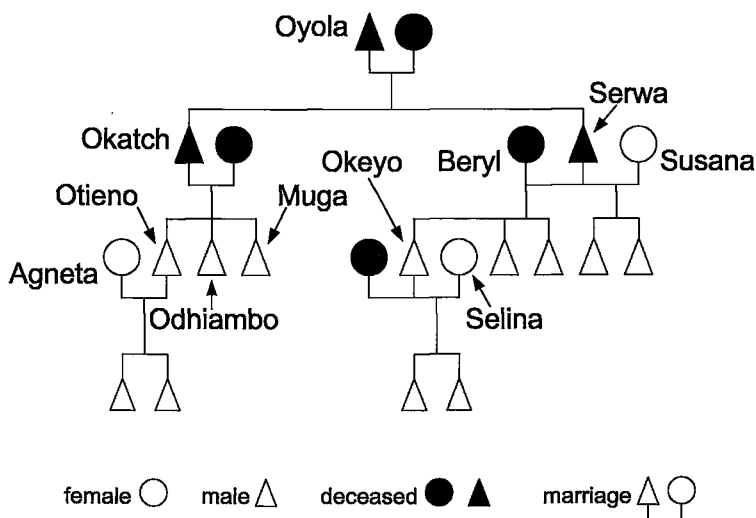
#### Case 5

Oyola was a pioneer church elder in Nyamninia village. They were the first Luo to inhabit the village. He belonged to the Ugenya sub-tribe who was allies of the Gem sub-tribe. Together, they fought and drove away the Abaluhya from Nyamninia. They can also be considered as *weg lowo* ('real' landowners). Since Oyola was born into a Christian family, he had only one wife, with whom he had two sons, Okatch and Serwa. His eldest son Okatch was one of the pioneer farmers during the colonial period. He was the first person to grow coffee in the village and he became the first Chairman of Gem Coffee Co-operative society. Okatch had 3 sons and 2 daughters. His first son James Otieno is still alive. The other two sons died in 1997 and 1998 respectively. I managed to interview his last son Erasto Muga before he died in 1997. Okatch himself died in 1984. Before his death, he was a church elder in the Anglican Church.

James Otieno was born in 1934 in Nyamninia village. He worked as a surveyor for many years. In that capacity, he travelled to many places around the world, among them Japan and Germany. On retiring in 1991 he established his own home. He had previously been living in his father's compound. He owns 2.5 acres of land that he inherited from his father. He bought other plots that are in different places in the village. James was not really on good terms with his two brothers Erasto Muga and Jacob Odhiambo. The main problem was about land and women. James followed his father and grandfather's example by marrying only one wife. However the other two brothers invested in wives.

*'Our father did not have a big parcel of land. As I concentrated my efforts on educating my children, my brothers concentrated their efforts on marrying women. My two brothers are now dead. They have left behind a total of 33 children. All of them under my care. Erasto had four*

wives and 20 children. One of his sons who was a little bit responsible has died of AIDS. Jacob had 3 wives and 13 children. Of these, 3 sons have so far died of AIDS, following each other closely in a row. He has only two sons who are working'.



**Figure 6: The descendants of Oyola**

James has five children, two sons and three daughters. All of them have completed university education and are employed in the civil service. James himself is retired and has a pension. He has enough for himself and his wife Agneta. However, he is not at peace with himself. His brothers' sons are a bother to him. Every day he has to part with money to their homes for food. When I held my last interview with him, one of his nephews came and begged for KShs 100.00. They had not eaten a proper meal for two days and were very hungry. They needed the money to buy maize. Whenever there is a problem in any of his brothers' homes, he has to sort it out as he is the only elder left in that family. If there is a death, he has to slaughter a bull for the funeral. His younger brother Jacob Odhiambo died in 1997 and left behind a large family. I did not manage to interview him. However I managed to interview the youngest brother Erasto Muga who died in 1998.

Erasto was Okatch's last son. He was born in 1938 and has 4 wives and 20 children. At the time of my fieldwork, only one of his sons was working, as a casual labourer in Nairobi. Two were in jail serving a two year sentence for theft. Erasto had two acres of land, which he inherited from his father.

Out of these two acres,  $\frac{1}{2}$  an acre has been taken by the homestead and the remaining  $1\frac{1}{2}$  acres is divided among the four wives. They work on very small plots. They try to grow maize on these plots but their yield is poor because the soil nutrients are exhausted. They live by selling their labour. They try to get at least one job each day, otherwise they go hungry. They have formed a women's group with other poor women farmers in the village. They help each other in the evenings as a group during peak labour periods. In the mornings, they work for rich farmers, to earn money for a day's food. They do not work well on their plots because they go there in the evenings when they are already tired. Their plight is almost that of a landless family, but family labour is abundant. They rely mostly on their brother-in-law when they get stuck. Their children also sell their labour just to get something to eat. Some of them steal, which is why two of them are in jail.

The last wife of Erasto also supplements her income by brewing *Changaa* (an illicit brew outlawed by the government). She always has a small amount of money to bribe the police not to arrest her when they come. This liquor is very strong and its alcohol content is unknown. People do not sit down to take it but are given a glass, and they quickly drink it and leave. If they delay they face arrest by police.

Here is a case where land conflict is not explicit. The brothers all have their parcels of land. But due to poor family planning, their small parcels of land cannot meet their subsistence needs. James, who invested in educating his children, succeeded, but the fruits of his hard work must now help to support his brothers' families who have only him to turn to for help in Okatch's family.

Since all James' children work in town, he works the farm with his wife Agneta. He has hired a herd's boy to herd his African zebu cattle and sheep. He supplements his own labour with casual labour from the Abaluhya, who come from the neighbouring Kakamega District. He laments that his fellow Luos in their village are unwilling to work for him, and his nephews will never work on his fields no matter what price he offers them. The same applies to his sisters-in-law whom he is now taking care of.

*'I am everything to my father's family, his sons and grand children. I have to work in my farm with my wife the two of us. If I need extra labour, I have to hire Abaluhya from Kakamega District. My nephews cannot help me on the farm. Their mothers will not allow them. Secondly, it will be seen as if I am enslaving them even if I have to pay them. The world has changed. When I was young, people used to pool labour as a Jokakwaro or Jokadayo. This was called Saga. It was very effective. But nowadays even if you have money, nobody wants to work on your farm. My nephews and sisters-in-law, wives of my two brothers, cannot help me. Yet they work on other people's farms. However, I am expected to help them. I am alone and my age is advanced'.*

They will not work for him but want to be assisted. He is willing to pay them. Obviously monetarisation of labour alone is not a guarantee that you can attract labour from around.

James told me that labour would not be a problem if close relatives would accept working for you for wages. But the Luo lineage set up and custom does not allow relatives or kinsmen to work for one another and be paid. So within one clan in a village, it is problematic. Also buying and selling of things among clan members is not acceptable. It might lead to problems, a sort of *Chira* (a disease with unknown consequences), because what belongs to the clan is considered to belong to every person of that clan. He told me that if one has a problem then one requests help from fellow kinsmen. This help should be offered if possible and should be nothing akin to buying or selling.

Further, James said that labour is also a problem in his village because of peoples' attitudes. It is, moreover, a generation issue. Young men are white-collar job oriented. This dates back to colonial times. He said that boarding a train to work away from home makes young men feel they are really employed. However, they feel degraded to work for their fellow kinsmen. This is why most labourers in the village come from the Abaluhya community.

Serwa, Oyola's second son, was born in 1913. Unlike his brother Okatch, he joined the Catholic Church at Yala Mission, three kilometres from their village. He spent his youth in the mission as a catechist. When he married, he became a lay reader in the church. He did not concentrate much on farming. His children were living with him at the mission. He was one of the earliest to receive an education in the area. He had three sons and a daughter by his first wife Beryl. Later when he retired from the church, he married another wife, Susana, and had two sons. Beryl's first son, Charles Okeyo, is a retired education officer and is living on a 40-acre farm in Rongai where he keeps 150 dairy cows. His wife Selina teaches at the Nyamninia Primary School. We frequently met at her home and she was interviewed intensively.

Okeyo's two brothers live in town. One is a retired high-ranking Railway functionary and now lives in Mombasa where his wife is a nurse and the other is a retired engineer who has opened a private consultancy firm in Nairobi. Their father Serwa apportioned them all land according to their mothers. Beryl, Okeyo's mother, was given six acres and Susana four acres. Selina now works her mother-in-law's six acres because her brothers-in-law are in town. If they should return then she will work the two acres that belong to her husband. All her children are living abroad. Her eldest daughter is in Switzerland and the rest are in the United States of America, where two are in education and two are working.

I later learnt that only two of the children were Selina's. The others are the children of Okeyo's first wife who died a long time ago. Nobody in the family

mentions this woman. Selina has usufructuary rights to the land of her brothers-in-law while they are away, because they are of the same mother. They allow her to work the land and Selina has no conflicts with either her stepmother Susana or with her brothers-in-law. However she has a problem with the children of Erasto Muga, her husband's first cousin.

Selina's farm neighbours Erasto Muga's farm. Muga's children steal her maize. She cannot order their arrest because Erasto and Okeyo share the same grand father. They are *Jokakwaro*. If she orders their arrest, and one of them dies in jail, this could lead to wide family hatred that would involve so many in their lineage.

Selina works with hired labour mainly. Most who come to work on the farm are Abaluhya from the neighbouring Kakamega district. Luo kinsmen from her village do not want to work for her. She says that they are jealous.

*'They have a feeling that we are wealthy. Personally I do not think so. We are just hard working. The little we get, is what we use to support ourselves. Even the children of my close relatives from this village cannot work for me. Instead they steal my harvest. Some steal the maize even before it is dry.'*

She says that nowadays labour is more expensive. Long ago people used 'saga' which was almost free and a useful way of pooling labour. Nowadays labour is monetarised and able-bodied youngsters are also not willing to work in the field. *'They lack that charity that begins at home'*. She says that parents of today are too soft on their children. It is a matter of education.

*'I have hired two permanent non resident labourers who help with my crop fields. They also weed the napier grass field. One extra labourer I have employed is stationed in the unit. During peak periods, I hire casual labourers to help in offsetting the labour demand. However I still face labour problems. The work involved in the unit is labour demanding and tasking. Most of my labourers leave simply because of too much work in the unit. During dry seasons napier grass is usually in short supply and so I do release the animals to graze in the paddocks.'*

Land preparation takes place from December until February in the long rainy season. The land is dug twice. Ox-ploughs are preferred but ox-ploughs are few. The price for hiring them is high and the quality of the service delivered is often low, since those with ploughs want to rush from one field to another to make as much money as possible. But it is very often not easy to get ox-plough men to come because demand is high. This means doing the job yourself using a hoe. Selina normally cultivates with a hoe in the short rainy season. In the long rainy season if she misses ox-ploughing, she hires labour for land preparation and weeding. She hires poor women from around and the Abaluhya from neighbouring Kakamega and Vihiga district. The Abaluhyas are hard working and they do not complain. They only allow themselves to be paid after work. The Luos, particularly from her village, like to get paid in advance and they normally complain more.

However Selina does not agree that Luos are lazier than the Abaluhyas. The reason the Abaluhyas come to work in their village is due to overpopulation and very small plots in Western Province. People thus work on their plots early in the morning and then go looking for additional income. The problem of small land sizes is great in Siaya but not as great as in Kakamega or Vihiga. Selina also claimed that Luos underpay their fellow Luos or pay them too late. And they often need money the same day, which makes them hesitate to sell their labour to other Luos. If Luos are treated the same, they will work as hard.

This case is representative of issues related to labour mobilisation. It also highlights a situation where early education can bring big social differentiation within a lineage. Okatch managed to educate only one of his sons, James Otieno, which landed him a good career as a surveyor. His brother Serwa managed to educate all his children, thanks to the missionaries at the Yala Mission where he served as a catechist. Serwa's lineage thus are better placed than Okatch's, whose other two sons, Odhiambo and Muga invested more in marriage to many wives than in their children's education. This is now a burden to Otieno, who has to provide for the subsistence of his two dead brothers' families. In return, Otieno is unable to draw on their labour because they do not want to work for him for free, nor for pay, since customarily he has an obligation to take care of them. On the other hand the nephews steal from Okeyo their step uncle. Selina Okeyo finds it difficult to draw labour from them as well. In this case we find a situation of a lineage where labour is abundant but it cannot be mobilised because kinsmen do not like working for kinsman though they expect help from their kinsman by virtue of being kinsmen. Like many other cases, it is always hard to work with your own kinsmen. If you succeed in tapping their labour, they always ask for high salaries and you cannot argue too much as you are related to them. Also there is no guarantee that they will work for you.

#### *Case 6*

Ochieng Monye lives in Muhanda village. He represents young men who never migrated to town. The realisation that there is no employment in town made him decide to settle in farming. He was an adaptive research farmer with CARE-Kenya. His mother is long dead. Ochieng is unmarried and has five brothers. He himself is the third son. His eldest brother is married with children but still lives within his father's homestead. This brother has 0.5 acres that he cultivates permanently. The other 5.5 acres of arable land is still in their father's name and he holds all the title deeds. Ochieng and his other brothers have usufructuary right to use the plots within it. Ochieng sometimes complained that interference from his eldest brother made it very difficult for him to farm properly. His brother can obstructs his efforts by planting late and Ochieng can

only plant after his elder brother has done so. He complained also that his father had once rebuked him for sowing peas on a piece of land without his permission.

Sometimes the elders take their time planting and for hybrid maize such traditions are not suitable as its preparation and storage does not fit with Luo customs. It is an outside seed. To avoid problems if he puts the seeds in his old father's hut the night before planting, and his old father then first plants a small corner, which makes it then possible for Ochieng to plant. Alternatively they buy seed from the market and plant direct to the field. If they plant early, they naturally harvest early and in this case the harvest has to be taken to the old man's house.

In the 1998 long rainy season, which normally begins in March and is the main planting season, Ochieng was involved in research with CARE-Kenya on his farm. The research was aimed at testing the performance of the tithonia weed as green biomass manure at various quantities. Ochieng prepared his field early enough. But when CARE-Kenya officials came to plant, they were turned back by villagers. They were asked to wait until *golo kodhi* or first planting had been observed. They left disappointed but they had to wait.

Most of the half year of 1999 and the early part of the year 2000, Ochieng was very sick. Farmers gossiped about his illness. Since Ochieng was a young dynamic farmer, most extension workers and researchers from various organisations used his fields as demonstration plots. This often caused conflict between him and his father, who felt that Ochieng was trying to *golo kodhi* earlier than him. He believed that one day Ochieng might violate this principle, and thus when Ochieng became sick, people started to say he was suffering from *Chira* as a result of planting before the father. Ochieng was quickly losing weight<sup>12</sup> and developing a variety of complications. His ailment was unknown. One day when I visited him, his father distanced himself from the issue of Ochieng's illness by saying

*'Your friend is suffering from Ayaki (AIDS). He was not married and I could see different kinds of ladies coming to get vegetables from his farm. Some ended up in his hut. These agriculture people have brought so many projects to my son that have acted as bait to his life'.*

Other farmers share these sentiments. Odar Masa (born in 1911) who is a real case of *Jagol pur* in Nyamnina village is one of them. I met him in the compound of Ochieng's father. He had come to share with Ochieng's father ways and means to save Ochieng's life as they were great friends. Odar believed that most fields were not doing well these days because of people violating the *golo kodhi* principle. *'People have become individualistic and are divided. This is anti-progress since people no longer help one another. The occurrence of*

---

<sup>12</sup> One of the symptoms of *chira* is losing weight with one complaining of general malaise.



*chira* has really increased because people no longer respect Luo values and customs'. Odar justifies this by the occurrence of AIDS. Ochieng's father also concurred with him over this. They both believe that this is a curse on Luoland. Odar:

*'because of the changes that are taking place nowadays, there are no longer any antidotes for chira. Most elders who knew manyasi have died without passing on their skills to the current generation who are no longer interested. So the elders (who claim to know manyasi) today practise it because of poverty. They do not have the real skills to heal anyone. In fact they are endangering themselves'.*

*Chira* is a disease without clear, distinctive symptoms. The emergence of AIDS with its similar symptoms has caused confusion. It is hard to distinguish AIDS from *chira*.

Ochieng Monye represents those who remain in their own villages to farm for a living as an alternative to the uncertainties of town. Because they are keen on farming, development practitioners target them most. And since most young men who have not managed to marry have few financial obligations, they can carry the risks of experimenting with new technologies. Because they are curious to try out new technologies they sometimes find themselves on the wrong side of Luo culture. They contest Luo cultural practices such as *golo kodhi* and *dwoko cham*, which they see as an impediment to their farming, particularly in planting crops like hybrid maize that require timely sowing at the onset of rains. But they are obliged to obey their parents and grand parents on whose homesteads they live. To wield power over the youth and successfully bring them under control, elders warn them of *chira*, a disease of unknown consequences. Little wonder that when Monye became ill the elders were quick to point out it was *chira* brought on because of disputes with his widowed father over first sowing (*golo kodhi*). The case shows how culture can stifle agricultural practices and even lead to the non-adoption of certain technologies from external agencies. However, for the elders it is a useful way of bringing the youth under control.

#### Case 7

This case presents an old Christian woman in Nyamninia village, who was 'saved' in the Anglican church but still believes in traditional farming practices. Margaret Odera was born in Asembo, where as a young girl she saw people plant sorghum through broadcasting and maize also. She belongs to the Anglican Church. She observes *lemo mar buru* - the act of taking seeds to the church for prayers a month before the sowing date. Christians are able to bypass observing the traditional *golo kodhi* practice but Margaret observes this tradition. The day before sowing she takes the seeds to her hut again for prayers. Because Margaret and her husband only have a very small piece of land, there is no *mondo* and she sows therefore on her own plot.

Within the *dala*, *golo kodhi* is observed and Margaret must therefore sow first before her co-wife and her daughters-in-law can follow. For instance, at the beginning of the 1999 long rainy season, Margaret was in Nairobi. However, the people who remained at home had to wait before sowing their plots until Margaret had returned and planted her plot. Margaret herself always waits for her husband's elder brother to sow, even though the brother-in-law owns a homestead. Margaret, as a Christian, does not believe in *chira*. However, she finds it important to pay respect to the elders. That is why she observes *golo kodhi*. Furthermore, she always tries to sow as early as possible in order not to delay her co-wife and daughters-in-law. She states that

*'Most of the problems that the Luo community are facing today (frequent deaths, crop failures and famine) are caused by the violation of Luo customary laws by the present generation. The people of today have failed to maintain the old agricultural customs. It is also a sign that the end of the times that were prophesised in the bible is nearing.'*

Margaret believes that *Lemo mar buru* never delays sowing because it is carried out well in advance, i.e. one month before the onset of rains. Margaret stated that there is a home nearby where *golo kodhi* was still being observed strictly. She can carry out *golo kodhi* on her own since she is beyond child bearing age. However, she does not do this herself.

She told me that she is a 'saved' Christian and therefore *Chira* can never harm her. However, her daughter and co-wife are not yet at the same 'level' and *Chira* still poses a threat to them. So, Margaret who is the first wife, makes sure that she sows as soon as possible so that her co-wife and daughter-in-law can also sow in good time. In Margaret's view *Ochieng monye's* illness could never be *chira* since he was not yet married and, as she thought, he always used seed from his father's house. The seeds were never in his hut. That is why she believes he suffers from AIDS.<sup>13</sup>

Margaret does not practice *fwachra* but carries out *Dwoko cham*, i.e. bringing the first portion of harvest home. After this the co-wife and the daughter can follow. Thus she follows the gate issue in sowing and harvesting (first to go through the gate) but skips the feasting ceremony. *'The feasting ceremony actually died because the government outlawed the brewing of Busaa the traditional beer that used to bring the old men together'*.

Although Margaret used to sow hybrid maize, she never abandoned her family seed (*koth dala*) since *'with new seeds you always have to wait and see what it does'*.

This case shows a conspicuous combination of Christianity and traditional Luo culture. This is a very Christian family. One of the women of the family is

<sup>13</sup> At the time of this interview in January 2000, Ochieng was very sick and he eventually succumbed to his ailment.

married to a pastor of the Anglican Church. According to Margaret, the knowledge to cure *`chira'* is gone, because as a result of Christianity the elder women lost the practice of healing with local herbs. People that kept up the practice were regarded as backward, uncivilised and not modern. This way herbal knowledge got lost. Margaret does not believe in Luo customs. But for the sake of the people she is living with, she strictly observes the customs strictly. She does not want to be blamed for any problems in the family. There are many cases similar to this in the villages where I conducted my research.

### **Discussion and conclusions**

This chapter has dealt with historical development of Luo social organisation and in particular, its visible settlement patterns and how they have transformed over time. It revealed changes in the organising principles of Luo kinship relations in relation to land tenure arrangement and the problems of labour and the ideology behind the first sowing of seeds. The discourse of historical development and transformation of the Siaya landscape as a result of encounters with other values and norms, such as Christianity and contact with the customs of other African tribes like the Abaluhya and Kalenjin were presented as the background to the processes of change occurring in the Siaya landscape over the last century. Furthermore, the chapter highlighted what those dynamic Luo customs mean for the way agriculture is carried out, especially in the case of maize cultivation.

We have seen that the Luo are strongly attached to land, which means more than is generally assumed by land. It is not just a resource for agricultural production. A whole complex and dynamic set of social relationships is built around land, tying people together and defining their position vis-à-vis each other. Over the years, and to a large extent still, the key principle is that one can and could gain and maintain access to land by membership of a clan. Rights of individuals are not thought sacrosanct; rather, they interlock with the rights of others, and overlap with those of families and wider groups. A place on the landscape implies a place in a kin group, and vice versa. Patrilineity, virilocal residence and the subdivision of holdings devolving from one generation to the next remain socially defined norms in Luo country. The multiple meaning of land and the intrinsic complexities of Luo land tenure arrangements are often misunderstood by intervening agencies that aim to contribute to improving the conditions of life in Luoland.

The chapter has also shown that women do not normally inherit cultivation rights but acquire them mainly through marriage. Women's rights are only ancillary, depending on allocations from their husbands. Their position regarding land can also be seen from the angle of matrilineal relationships in a patrilineal society. Women are the ones who mostly work the land, and obtain

rights in their post-marital homesteads by devolution from their mothers-in-law.

Lomo from case one, and Martin from case two, represent numerous members of the younger generation who have developed a more individualistic attitude. They are eager to get their own title deeds, since this would enable them to make their own plans, without having to accept the authority of an elder, a father or a brother. However, in conflict situations, the owner of the homestead, in most cases the one holding the title deeds, tends to hold on to these deeds as long as possible to maintain his authority. In many cases, this hampers the construction of a proper inheritance arrangement, which could mean the continuation of the quarrel between sons after the father's death. In the 'old' days, the eldest son succeeded his father as head of the homestead. In more recent times however, younger brothers often question and challenge his position. Without title deeds it is difficult to get loans that would enable investment in agricultural production, in other economic activities, or in marrying other women.

The old Luo custom was that labour was drawn from relatives and friends within a *gweng*. This was called *saga*. When someone needed labour relatives and friends could be called upon to help in exchange for food. The monetisation of the economy, as a result of the interventions of colonial government, is held responsible for the disappearance of *saga*. Labour became a commodity, it obtained a certain value and people are no longer willing to give it away free, even, or in other cases especially not, to relatives. With the disappearance of *saga*, family labour has become very important on most farms. Rich farmers supplement family labour by employing both permanent and casual labourers. For small farmers, labour remains a problem almost every year unless they join small labour groups that are now emerging to replace *saga*. These labour groups are based on women, church groups or youth groups of which you must be a member to benefit.

With regard to crop production, there is the principle of *golo kodhi and dwoko cham*, the principle of seniority, which means that the eldest within a lineage or *dala*, should carry out certain agricultural activities, like sowing and harvesting, first after which the rest can follow again in order of seniority. Therefore, *golo kodhi* and *dwoko cham* influence agriculture greatly and are elements that are still embedded in farmers' cultural repertoires. This must have served a useful purpose when the agricultural experience and knowledge of elders would have contributed to wise decisions regarding when to plant etc. But with new varieties and choices in agriculture this custom is a hindrance to the young who wish to be more adventurous in their agricultural choices. However also in the case of *golo kodhi* there has been remarkable transformation as a result of encounters with Christian and Western values. Some people say they do not

believe nor practise it anymore. In other cases it is nowadays confined to the *dala*. Again others have replaced *golo kodhi* by Christian ceremonies, like going to pray in church before sowing maize. Thus we might conclude that the encounter of Luo and Western values and customs has resulted in transformation and increased diversity. This also indicates that although farmers, as lifeworld representatives, tend to share knowledge, this does not mean they hold exactly the same types of knowledge and this complicates the drawing of boundaries. The penetration of Christianity and other Western norms and values has intensified negotiations and has multiplied possible outcomes.

Oluoch Agulu, after every growing season, takes 10 % of his harvest to the Anglican Church of which he is a member. This custom has replaced the pouring of sorghum beer on the ground for the Luo ancestors. Some farmers openly state that they do not believe in Luo customs or in the consequences for disobeying them. Yiengo Rateng left his father's home before his elder brothers had done so because he felt Luo customs, like *golo kodhi*, prohibited him from farming in the way he wanted and obstructed his progress. When he left his father's home his relatives warned him of *chira*. Yiengo Rateng does not believe in that and he states that his success as a farmer and a businessman has strengthened his opinion.

People tend to organise their daily lives by doing their own things, but kinship principles and customary arrangements and obligations are far from dead. Although they are not talked about, kinship relations and customs still silently mediate the tensions of contemporary, everyday Luo life.

## Socio-technical regimes, networks and the spread of maize in Luoland

### Introduction

This chapter is about the formation of various technological regimes in the field of maize. The chapter narrates the history of maize in Luoland with an emphasis on the socio-technical networks through which the different maize varieties spread. The different breeding and selection regimes through which maize is bred and propagated are then analysed. Both represent specific socio-technical regimes, each with their own characteristics, social relationships and dynamics. But before I embark on a comparative analysis of these regimes, I need to elaborate the way in which hybrid maize spread in Luoland and in the Siaya region. In contrast, the spread of local maize varieties, the proliferation of hybrid maize, from the mid-1960s, involved the establishment of a particular socio-technical regime through processes of planned intervention to radically transform maize farming. The way hybrid maize spread differed also substantially from the earlier trial and error interventions of the colonial state. While maize varieties originating from these early state interventions still feature today, the hybrid maize regime never completely managed to fulfil its mission in the region. The adoption of hybrid maize in Luoland as a whole never went above 20%, and has always been planted alongside local maize, though never fully displacing it as in other areas of Kenya such as Nandi and Trans Nzoia (Hebinck, 1990). The specificity of the way hybrid maize spread thus warrants a separate section in this chapter, after which I will zoom in on the differences between the characteristics of 'local' and hybrid varieties. The chapter ends with an analysis of why people prefer local maize to hybrids.

Maize is the most important cereal crop in East Africa. It is not an indigenous crop to Africa and was first introduced in the sixteenth century by Portuguese traders. The plant originates from Central America, which is a gene pool or Vavilov centre for maize. Its proliferation in the East African highlands and medium altitude areas is a relatively recent development. When maize appeared in the Luo landscape at the end of the 19<sup>th</sup> century, it quickly became incorporated into people's lifeworlds. The normal practices for sorghum and millet were extended to maize and the seeds became family seeds (*koth dala*). A wide variety of local maize has been grown since its initial spread and is still planted today. When 'modern' maize varieties were introduced later through a variety of socio-technical networks, rural people responded quickly and

adopted the new varieties, albeit in a redesigned way. But now twenty or more years later, modern or hybrid maize varieties are hardly grown. Instead, 'local' varieties of maize are the predominant feature of the landscape. Why this has happened is explained in this and the next chapter.

According to farmers, local maize is the variety they grow and select themselves through mass selection. Scholars and plant breeders label these local varieties as land races (Louwaars and Marrewijk, 1997: 128). They are not registered or formally marketed and exist only to the extent that they are used in farmers' fields and fit the farming practices of the Luo. The seeds are maintained and developed through annual mass selection from the previous year's harvest. Local maize is different from modern and hybrid varieties, which are generated through maize breeding programmes.

### **Socio-technical networks and the proliferation of maize in Luoland**

The Luo originally planted sorghum and millet grains<sup>1</sup>, but these have been gradually and largely replaced by maize as the major crop. Both red and white varieties were grown. Luo women used sorghum to make *Kuon* or *Ugali*, the starchy staple of the Luo. They ground sorghum into flour on a large grindstone with a smaller stone which fits the hand (*pong'* and *nyar pong'* - the grindstone and her daughter), then pour the flour into a pot of boiling water, stirring until the whole mass became thick and firm. Sorghum was also used for brewing beer, essential for the proper entertainment of older men. A number of travellers' accounts confirm the predominant position of sorghum in the agricultural system of the 1890s (Hay 1972: 95). Finger millet (*Eleusine coracana*), known locally as *kal*, was used for brewing beer and was rarely used for making *ugali*. Other crops included barley (*dongo*), sesame (*nyim*), pumpkins (*budho*), small red beans (*ng'or*), green gram (*olayo*), and small ears of maize with variously coloured grains (*oduma ma rachich*). They are the crops usually mentioned by our informants when they were asked what crops their fathers, pioneer settlers in Siaya, cultivated.

The ecology of northern Siaya presented new possibilities compared with the dryer areas from which the Luo migrated. The heavier rainfall during the short rains made possible the gradual development of a second agricultural season from September to November. During the 1890s, the people of Nyamninia, Muhanda and Muhoho were in fact still experimenting with different crops

---

<sup>1</sup> Millets and sorghums are generally the food of the Nilotes, for they are ideally suited for hot, dry climates, being able to withstand very high temperatures and remain dormant during periods of drought, resuming their growth when the rains begin again. Ogot estimates that *durra* - a variety of sorghum - was the staple food of the early Nilotes as early as 1000 AD (Ogot, 1968: 41).

during the short rains and usually planted sesame, vegetables, or pulses. It was later, with the incorporation of new varieties of rapidly maturing maize as a staple food, that short rain cultivation became a fully-fledged part of the agricultural cycle.

In addition to the gradual development of a second agricultural season, the people were experimenting with a variety of new crops, which were better suited to the new habitat than to the old. Lists of late 19<sup>th</sup> century crops never include bananas or sweet potatoes, yet when informants were asked when these crops were introduced, they claimed that the Luo had 'always' cultivated them. But the geographical evidence would indicate otherwise. They are not grown in the lakeshore areas. In the early 1980s, when I was in secondary education in the lakeshore region of Sakwa location, Southern Siaya, banana fields were never spotted. What is remembered is the traders from northern Siaya who came down south to collect fish, bringing with them bunches of bananas, which they sold at exorbitant prices.<sup>2</sup>

Although maize was grown in small quantities well before the beginning of the 20<sup>th</sup> century, it only came into prominence with the distribution of improved varieties of white maize during World War I (Heyer 1975: 146). By 1930, maize was already well established in Nyanza province. Maize was popular because of its higher yielding potential than indigenous cereals in areas with satisfactory rainfall and free draining soil. It is seldom seriously damaged by pests or diseases in the field and is virtually untouched by birds that can cause complete crop loss in some of the indigenous cereals. Land preparation, weed control and harvesting all require little manual labour, compared to some of the indigenous cereals, and no threshing or winnowing is required. Some people mention another advantage, namely, that maize is more palatable, but this appears to be a recent and local adaptation of taste.

The various sources of information confirm that maize came through different networks. These can be designated distinct socio-technical networks, because each played a role in bringing different maize varieties into the Luo landscape. These networks connect Luoland with the different sources or geographical areas of genetic material. Another element that differentiates such networks is that different kinds of actors are involved, each with a distinct capacity and role to play in both the way maize spread and the way it became transformed: traders, migrants, returning soldiers from the first World War, settlers, plant breeders, and so on. It is also useful to distinguish here the

---

<sup>2</sup> Hay (1972: 95) has shown that while the Baganda and Basoga of Uganda had cultivated the banana for centuries, it spread through the rest of Uganda and Western Kenya much more recently, reaching the Mount Elgon area only at the end of the 19<sup>th</sup> century. The Abaluhya might have learned of the banana from the Baganda and passed it on to the Luo.



voluntary and informal trade networks from those formally-organised networks based on breeding and selection programmes organised by state institutions in the country or outside Kenya, notably the United States and South Africa. Informal networks assist the spread of land races, or what I call in this thesis, local maize varieties. Formal networks, on the other hand, brought 'modern' varieties, which were selected from exogenous germplasm and bred for their higher yielding capacity or better suitability to some of Kenya's ecological conditions. The analysis of these socio-technical networks will show that some of them overlap and coincide or amalgamate. This is because, as we shall see, some of the maize varieties, which came to Luoland through famine and food relief programmes, through labour migration to the White Highlands, and through soldiers returning from the first World War, were, in fact, connected to maize breeding and selection programmes in the United States of America, South Africa, and later Kenya itself.

As mentioned above, the roots of maize can be traced back to the late 19<sup>th</sup> century. Based on local people's accounts and relevant literature, four different networks through which maize spread into Luoland can be identified. In the first place, *trade networks*. Portuguese traders first brought maize to East Africa in the 16<sup>th</sup> and 17<sup>th</sup> centuries (Acland 1971: 124). It was limited to the coastal areas up to the end of the nineteenth century but later spread inland. By 1643, maize was grown on Zanzibar and Pemba islands to supply the Portuguese garrison at Mombasa. There is some evidence that it spread inland along the routes followed by the Arab slave caravans.<sup>3</sup> The Caribbean flint types of maize imported by the Portuguese are still found in the coastal regions of East Africa and, to a varying extent, among local varieties inland. Their spread seems to have accelerated inland with the opening of the interior to external contact in the latter part of the 19<sup>th</sup> century. Captain Grant found it 'very rare' in 1863, while Sir Harry Johnston found 'Indian corn everywhere' in 1901. H.H. Austin found the slopes of Mt. Elgon 'thickly cultivated with bananas and Indian corn' in 1897 (Landlands, 1965: 217). These latter references are important. They show that lowland varieties of maize were established in the interior of Uganda and Western Kenya before the introduction of white maize, after 1900, by European settlers. Thus neighbouring Uganda was a major source of maize varieties that did, and still do, find their way to Siaya through trade relationships.

A second network hinges around the *food and famine relief programmes* organised by the colonial and post-colonial state - mostly of yellow maize,

---

<sup>3</sup> Among the Nyika of Tanzania the root word for maize is 'Pemba' and is presumably derived from the island Pemba, which was a base for Arab slave operations in the area. (Miracle, 1966: 113).

imported from the United States to deal with acute shortages of maize for consumption. Some of this maize was reserved as seed for the next planting season. In fact both colonial records and oral history ascribe a series of famines that occurred in the late 19<sup>th</sup> and early 20<sup>th</sup> century (see also Chapter 2) to the gradual shift from sorghum and millet. A third network is associated with *labour migration*. People seeking work in neighbouring Uganda, or on the white settler farms in the White Highlands of the colony, or soldiers returning from World War I, brought home new varieties of maize. The areas to which people migrated are crucial to the different varieties of maize brought into Luoland. A fourth network is linked to the various but different maize *research, selection and breeding programmes* of the Department of Agriculture of the colonial and post-colonial state, and also of the white settlers looking for new varieties that were better suited to the inland climate. The latter were invariably found in South Africa.<sup>4</sup> The yellow maize varieties imported from the United States in the context of famine relief of course also derive from breeding programmes. It was, however, the famine relief programmes through which these arrived in the region that are of significance here. Recently, some NGO-like institutions, such as CARE-Kenya and Lagrotech, have started breeding programmes, which are quite different from those linked to the formal research and breeding networks in the country, or elsewhere in the world. The socio-technical network based on research and breeding programmes is thus not homogenous, as maize breeding has evolved, over time, in different directions. But invariably these networks brought yellow and white varieties of maize, unlike the multi-coloured varieties spread through trade networks.

Together, these networks (see Table 4.1) brought a wide range of maize varieties, which in turn contributed ultimately to the rapid spread of the cultivation of maize among the African population and became the most important staple crop in Kenya (Gerhart 1975: 1-3).

It is not exactly known when maize was introduced into Siaya and which variety came first. It appeared sometime during the course of the 1890s. When Lord Lugard visited Nyanza in 1890, he saw 'little or no maize' (Hay 1972: 95).

---

<sup>4</sup> This is not surprising as a lot of Kenya's white settlers originate from South Africa.

**Table 4.1: Socio-technical networks of maize in Luoland**

Networks	Key actors	Varieties	Colour	Year	Sources
Trade	Traders	Radier	Multi	1890s	Coastal areas of East Africa via Uganda
		Rachich	coloured	"	
		Rachar	White	"	
		Rateng	Black	"	
		Rapir	White with red stripes	"	
Food and Famine relief	Colonial and post-colonial state officers	Uganda White	White	1982/84	Uganda
		Kawanda	White		Uganda
		Oking	White	1916	Unknown
		Ababari	White	1917	Unknown
		Nyamula	Yellow	1928/36/82	United States
Labour Migration	Migrants and former soldiers	Hickory	White	1950s	South Africa
		King			
		Radier	Multi	After World War II to 1970	Uganda
		Rachich	coloured		Uganda
		Rachar	White	"	White
Maize research and breeding programmes	Research, extension and stockists	Kazigo	White	1922	Highlands/ South Africa
				"	South Africa
		Kenya Flat	White	1960	
		White			
		Kitale	White	1961	Kitale, Kenya
		Synthetics			
		Hybrid 511, 512,	White	1964	Embu, Kenya
		Hybrid, 614, 622, 625, 626	White	1970-90s	Kitale, Kenya
		PAN 5195	White	1990s	South Africa
		PH1	White	"	United States
		Maseno	White	1996	Kisumu
		Double cobbler			

Sources: Acland (1971) and farmer and traveler accounts

Travellers to neighbouring Uganda first noticed the existence of maize in central Buganda and Bunyoro by 1862 and in Acholi by 1880 (Grant, 1965: 216-

219). Thus it is possible that maize travelled along the main trade routes from Buganda and Bunyoro to Mumias (North Nyanza) and spread from there into central Nyanza during the 1870s or 1880s (Wright, 1949: 61-81). Through contacts with Waswahili (people from the coast) and Arab traders in the late 19<sup>th</sup> century, maize most certainly also found its way to Siaya. Through such trade routes, varieties like *radier* and *rachich* (the multicoloured varieties of maize) entered Luoland. At the turn of the century other varieties surfaced in the region. Ogwang Madara explains:

*'I was born in 1914. I first saw my father in 1918, the year when Ndege (the aeroplane) passed over our village. My father was just returning from the First World War. During this time people would run and hide in their houses when an aeroplane was passing high up in the sky. People thought that the sky was tearing apart. My grandfather was still alive then. He and another friend were working as porters for the first missionaries who came here. When they went with the missionaries to Baganda, they came back with these seeds. By then people were just trying them. This was before the railway line reached Kisumu in 1901. On their way to Uganda, they also saw fields of sorghum inter-cropped with maize.'*

A white variety (*rachar*) was already being cultivated but was not widespread. Two other white varieties that were first to arrive and are still planted today are the *oking* and *ababari*. The *oking* and *ababari* varieties are locally referred to as *mzungu* (white) maize, since they were selected and bred by white people and first introduced by the colonial department of agriculture. Both varieties came as part of famine relief programmes. *Oking* was introduced during the great famine of 1906-1907. *Ababari* and possibly other white varieties were introduced following the great famines of 1917-1919, during the First World War. Farmers still plant these two varieties of maize and identify them with reference to their physical (phenotypical) characteristics. *Oking* means hard in *Dholuo* and is a maize variety with hard (dent) grains that cannot easily be attacked by weevils. Mr. H.H. Holden, a Luo-speaking West Indian who was employed by the Department of Agriculture, introduced *ababari* in Siaya in 1917. *Jaduong* Odar Masa told us that Mr. Holden came to their farm when he was very young. He gave them maize seeds, which they called *ababari*, because they were larger than the seeds of *oking* and other earlier varieties of maize such as *radier*. *Ababari*, according to Odar Masa, means a '*great thing*'.

The spread of maize cultivation in northern Siaya took place at an earlier stage than in most parts of Luoland due to the coercive intervention of Chief Odera Akango of Gem (in the North Eastern parts of Siaya), where the research was conducted. According to *Jaduong* Ogwang Madara, Chief Odera Akango was an '*eye opener*' for the people of Gem. He was a young chief who brought progress by force. He was the chief of Gem location during 1915-1916, and although still quite young, he had a big homestead and a very large farm in Nyamninia village.

*'He was a ruthless leader, who was very strict about development activities. He observed seriously the date of planting. Once the elders had discussed the rain with the rainmaker, they were to plant immediately. Thereafter everybody had to plant. This was a must. Failure to do so meant being caned. He hated lazy people and employed 30 askaris (soldiers) to look around for lazy people who did not cultivate their land and grew few of crops. These people were brought to his weekly barazas (meetings) and caned in public'.<sup>5</sup>*

Everybody had to practice the farming methods of 'the white' man. Odera himself was a big farmer and even planted rice. He was such a great chief that pupils in Luoland composed a song for him.<sup>6</sup> Another informant, Jaduong Andrea Manyasi, who was born in 1912, also echoed these sentiments of Ogwang Madara. He told me:

*'Chief Odera Akango brought another white variety of maize when he came back from a visit to Uganda. This was sometime in 1916. I was too young and I did not know much. My mother told me more about Odera Akango. Then soldiers who were returning from the First World War brought quite a number of maize varieties. In 1922 the Europeans brought another white maize variety, which they called kazigo. This variety cannot be traced now. When I was born, maize had already been introduced in Siaya. We used to grow radier and it used to do well. Wazungu (Europeans) brought yellow maize in 1928 at around the same time they brought cassava'.*

According to Andrea Manyasi, the first yellow maize came alongside cassava and sweet potatoes, which are drought tolerant crops. The man who brought the variety lived in a remote village. The variety is still grown and is referred to as *nyamula*. Another local variety that is still grown in Siaya is *rateng* (black maize) which is common in the semi-arid areas. Its major advantage is its very short period of maturity (70 days). It can therefore be planted later than other varieties. Its source was not established specifically, however, as most farmers mentioned that they just discovered it in their fields and continued propagating it. There are also multicoloured local varieties that are grown in Siaya.

Manyasi further said that in 1936 the rains failed, resulting in a bad year and shortage of food in Siaya. Maize was imported by the colonial government from the United States of America and distributed to farmers as part of famine

<sup>5</sup> Odera went further, according to Ogwang Madara. He also 'improved the manners of the people', as he disliked people who were greedy. When he heard of a person who liked eating too much, he ordered that he be brought to his home where he gave him many dishes of good food to eat and finish. If the greedy person did not finish the food, Odera Akango had him caned until he said he would not complain of hunger again. According to him, such people were lazy and would soon turn out to be thieves.

<sup>6</sup> Ndalo Odera Akango (2x)  
Chon gi lala ka piny pod nindo,  
Okelo ndongruok kod skunde,  
Nyithindo osomo gi tekone (2x)

During Odera Akongo's era  
Long time ago when people were still in the dark,  
He brought development and schooling,  
Children went to school through his efforts.

relief. Farmers then tried to plant this yellow maize (*nyamula*) as well. It was different from the first yellow maize brought by the Europeans, and the variety did not do well.

At a later stage, the government introduced the Hickory King maize and other varieties originating from South Africa to replace the yellow maize varieties. Such state responses to famine, and the early activities exemplified by Mr. Holden fits the general pattern that the colonial state tried almost everything to introduce industrial crops (such as sesame and cotton in Nyanza) and improved varieties of food crops (see Kitching, 1980).<sup>7</sup> From the mid-1960s onwards, various varieties of hybrid maize, such as H512, H511, H622 and H614 were introduced in Luoland and the Siaya region. These (invariably white) varieties are the result of a fourth socio-technical network closely associated with planned state intervention, involving maize breeders and their breeding programmes in Kenya or elsewhere and discussed in detail below, but also extension, credit, and marketing agencies. These varieties are all bred by the Kenya Seed Company (KSC) in Kitale. KSC, which held a monopoly position on the Kenyan seed market until the market was liberalised in the early 1990's and other seed companies were allowed to sell seed to farmers. This resulted in more recent entries of hybrid varieties, such as PAN 5195 and PH1 from Pannar, and Pioneer maize breeding companies in South Africa and the United States respectively. The spread of hybrid maize and the kind of varieties that were introduced will be discussed in detail later in the chapter. Hybrid maize, however, is not very popular in the Siaya region as we will see later on and in the following chapter.

The most recent local maize variety widely grown in Siaya can be traced back to 1982/83. It is called *nyauganda* (Uganda white). It found its way from Uganda to Kenya through traders going to Uganda to purchase maize during the great famine of *Gorogoro* in 1982/83. It is quite popular in Siaya and widely cultivated. The *gorogoro* famine, like earlier famines, triggered off state organised famine relief programmes. Again yellow maize from the United States was imported and the seed reserved for the next planting season. However, the variety did not survive in the Siaya environment.

---

<sup>7</sup> In spite of the enormous support for white settler and estate agriculture, colonial state officials stationed in the Reserves, in Nyanza and Kikuyu land in particular, also encouraged cash crop production by Africans. The fact that some sections of the colonial administration were actively engaged in encouraging agricultural development in the Reserves is an indication that the colonial state was not a monolithic apparatus and that the colonial administration was capable of perceiving interests other than those of settlers only. The purpose of this innovation was, however, simply to generate cash income so that Africans could pay taxes in money instead of livestock, of which the administration then had to dispose.

A very recently introduced white maize variety is the so-called *Maseno Double Cobber* (MDC). Lagrotech, a private seed company with offices in Kisumu, breeds this variety and released it in 1996. Although farmers were initially enthusiastic about MDC, it is not widely grown, since farmers who have tried it have learned that yields decline when its seed is used in the next planting season. Thus they continued to seek more stable local varieties, whose yields do not decline with time. The difference between the breeding of the MDC and hybrids will be explained later.

According to Cohen and Atieno Odhiambo (1989), the Luo generally responded in an ambiguous way to the introduction of white maize into the texture of Siaya life. In the twentieth century, the consumption of white maize meal has been associated in Siaya with the process of 'Westernisation'. White maize first entered the local economy through the intervention of the colonial government, and the maize meal was consequently first referred to as *Kuon Ongere*, the white man's *ugali*, or white man's food. Those who went to school planted maize almost as if it were part of their curriculum. They valued maize, and identified with the esteem accorded it, and so maize acquired another identity: as *kuon jonanga*, the *ugali* of the 'clothed' people. So, through a combination of pressure from the colonial authorities and their agents in Siaya, and through the appropriation of the special status given to it by those first coming to see themselves as the new elite, maize gradually seeped more broadly into the diet and production of the people. White maize was seen as a status symbol by the local elite in Siaya (Cohen and Atieno Odhiambo, 1989: 64) and became thus associated with the adoption of new life styles, with Westernisation and 'modernisation'. From this new elite, the growing and consumption of maize gradually found its way into all segments of society (Van Kessel, 1998: 29). This perception was also extended to hybrid maize.

### **Maize selection, breeding and networks**

Having described and explained some of the phenomena concerning the proliferation of maize in Luoland and the Siaya region, I can now examine how to link these issues and social processes together. One way to do so is to focus on the networks surrounding maize breeding and selection. Such processes are intimately linked with the way its cultivation spreads. Through breeding and selection maize becomes produced, multiplied, propagated, and the planting material preserved.

Roughly, we can distinguish between *breeding and selection practices based on mass selection* and the *breeding of hybrids*. What we get here is the co-existence of various regimes, and a predominant regime that increasingly evolves into different trajectories. The maize from the *mass selection and breeding network* tends to float freely around the area and travels, as it were, through trade

relationships across the border with Uganda. This network seems to be locally specific and is organised around locally prevailing conditions such as taste preferences, cultural dimensions of farming, soil fertility and maturing characteristics. Such networks are socially and culturally regulated by the (changing) cultural repertoires of the Luo. This regime is referred to as a 'niche' or 'informal' socio-technical regime. The *hybrid maize network* is based upon markets and specialised institutions in Kenya that are increasingly global due to trade liberalisation and privatisation. Regulation in this network is essentially based on the market and technology relationships prevailing. This predominant maize regime is, for the time being, labelled as the 'modern' or 'formal' socio-technical regime based on hybrid maize breeding and selection. These two networks entail different actors, produce different artefacts, rely on different bodies of knowledge, and serve distinctive aims. Sometimes the two encounter each other and the different bodies of knowledge that they generate and practise are contested. Let me describe first the two different ways of breeding maize.

#### *Breeding through mass selection*

Through the mass selection of seeds from the previous year's harvest, local varieties are in a process of continuous change. The actual selection for the coming season begins in the field and the selected cobs are partially dehusked and then hung in the kitchen above the fireplace. This selection is based on *phenotypical* characteristics of the maize stalk and the cobs. Only the large regular cobs are selected, and only the seeds from the middle part of the spindle are used for sowing. Mass selection is effective in increasing gene frequencies for characteristics which are easily measured, such as plant type, dates of maturity, grain characteristics, disease tolerance, tolerance to drought and strength of the stalk. It is therefore relatively easy for farmers to select for large cobs, early maturity and other easily recognisable characteristics.

Maize is a typical open pollinated crop. In an open field, each plant has a different genetic composition each with different individual characteristics. In practice, a farmer chooses his seed from desirable individual plants or cobs. The seed from these different plants are shelled, mixed, stored and planted *en mass* to produce the next generation. This is done practically by all farmers, who select their own seeds for the next season. Some farmers use the same method to produce their own local maize seed, some of which has proved to perform better than hybrid maize with minimal physical inputs.

In the research villages, people generally select and breed maize seeds that mature early, can be grown under conditions of unstable rainfall, resist pests, have the ability to yield when cultivated even without inorganic fertilisers, and suit specific end uses such as taste and palatability.



James Otieno Okatch (see case 5, Chap. 3), who resides in Nyamnina village, is one such farmer who generates his own maize seeds. The story of Otieno and his maize seeds is rather telling in that it shows the dynamics and particularities of a niche co-existing with a predominant socio-technical regime based on the mass selection and breeding of maize seeds. After his mother's death in 1989, his wife remained at home to continue the mother's farming activities. It was in this year that they planted hybrid maize for the first time. But given that he is the eldest son among three brothers, it was imperative that he plants, according to custom, before the families of the other brothers. According to the *golo kodhi* principle, he had to use family seed and was thus obliged to use the seeds that his mother would have been keeping for the purpose. He was lucky to find some seed hanging above the fireplace in his mother's kitchen, and since he had many African zebu cattle he had enough manure to plant both this family seed as well as hybrid maize. He bought no fertiliser as he was financially depleted after his mother's death. After planting he reported back to his work place in Nairobi, leaving his wife behind to take care of their homestead. However, what astonished them most was the performance of the family seed he had found compared to the hybrid maize they grew.

Most people did not believe what they were seeing on Otieno's farm. They gave it many interpretations, one of which was that it had received a blessing from Otieno's lately departed mother. They kept telling Otieno that his mother had blessed the seed because he had treated her visitors so well at the funeral. There had been enough beer and food. The elders were pleased with Otieno because 'he did not tie money to his pockets'. Before drinking beer they poured a small portion on the ground to honour Otieno's ancestors. In 1991, Otieno retired and came home to settle. The performance of the maize seed they inherited from their mother is something he is very proud of. He shows them to everyone who visits him and is interested in farming. Since nobody knew exactly what type of maize variety it was, Otieno gave it a name, zero-type. This maize does very well with organic manure alone and is virtually free of *striga*. Most villagers have bought seeds from him to try out, but the majority have depleted them during famine periods when they have had to consume everything.

Otieno generates the seeds through mass selection, which begins in the field. The first criteria he uses to select the cobs is to examine the stem, which should be big and strong. Then he looks for stems with large and healthy leaves. Third, the cobs should droop downwards after attaining physiological maturity (after the grains have reached a dough stage) since, according to him, this ensures that as the maize is left in the field to dry, water cannot enter the cob. Fourth, the cob should not open to expose the grains to pest attack and

water. Fifth, the maize stalk should have prop roots up to the third node above the ground to resist lodging. Lastly the spindle of the maize should not have less than twelve lines and should be well filled with the grains. Otieno learned these criteria from his parents. Otieno does not know much about hybrid as he says that he will stick to the family seeds. His brother, Erasto Muga no longer has family seed since up to the time of his death in 1998, Otieno was no longer willing to give him more seeds. He had repeatedly supplied him with the seed, which he then lost through consumption. His wives now plant local yellow maize instead. Through yearly mass selection, Otieno has managed to maintain the zero type successfully.

Because Otieno (and others in a more or less similar position) obtains sufficient manure from his cattle pen, and has good family seeds, he is no longer linked into the market for maize production. Moreover in Siaya, farmers do not buy store chemicals for their seeds. Instead they use ash burnt from dry cattle dung or from sedges that grow in swampy places down the river. The mass selection network is part and parcel of a development pattern that has de-linked or distanced itself over the years from the state and market institutions generating maize seed for 'development'. This represents a technological 'change from below', or what I term hidden novelties that form a niche within the socio-technical landscape.

John Ndugu, a plant breeder stationed at KARI-Kakamega regional research centre, is not convinced of mass selection because he claims,

*'it is not effective in modifying characteristics such as yield, which is governed by many genes and cannot be recognised by the appearance of individual plants or cobs. Mass selection takes place on the basis of phenotypic characteristics. These only to a limited extent reflect the genotype for the yield-components, and mass selection is therefore not an efficient breeding technique for increasing yields. The ineffectiveness of mass selection in increasing yields results from farmers inability to identify superior genotypes from phenotypic appearance of maize cobs, as the criteria for mass-selection is the phenotypes: superior plants being pollinated from both inferior and superior ones, so that high yielding potential is not produced in all its progenies, and lastly strict selection for specific characteristics, e.g. maturity or grain type, which often leads to inbreeding depression and thus to reduced yields'.*

According to this plant breeder, high yield is what is important in a plant breeder's agenda, while, as we shall read in the next chapter, high yield is not necessarily the first priority for most farmers. It can even rank as number four in a farmer's agenda.

#### *Hybrid maize breeding and selection*

The current hybrid maize regime is an outcome of earlier breeding programmes that took place in Kenya during the colonial era. Deliberate maize breeding started in 1955 (Ogada 1969: 5) with a local maize variety called

Kenya Flat White, the variety commonly grown by white settler farmers. According to Michael Harrison, the 'father' of hybrid maize in Kenya, the most successful maize varieties introduced from South Africa were Hickory King, Natal White Horsetooth, Ladysmith White, Salisbury White, Champion (Potchefstroom) White Pearl, and Iowa Silver Mine. The colourful names of these varieties reveal their origins; they were 'white southern dents' introduced to South Africa before the Boer War from the southern United States. They in turn derived from the Mexican dent race 'Tuxpeño'. During a 1959 visit to Mexico, Harrison reported that he saw true Tuxpeño ears and found them 'indistinguishable' from their long-removed Kenyan cousins (Harrison, 1970). Once transplanted to the Kenya highlands, these varieties became inextricably mixed, and a new variety developed which has come to be called Kenya Flat White. This is a variable but reasonably stable mixed population with large white kernels. The ears are large and cylindrical and average 12-14 rows. The plants are tall and late maturing and are relatively resistant to leaf blight. These plants were selected by leading farmers over a period of thirty or forty years both in the field and in the crib with the result that, when the original introductions were re-imported in the 1960's from South Africa and North Carolina for trial in Kenya, they were much more susceptible to disease and yielded less than the Kenya Flat whites with which they were compared. Thus, well before the new Kenyan hybrids were produced, local selection over many years had produced a well-adapted parent population. It is a lucky exception that in Kenya maize is both a subsistence and an export crop. Elsewhere in Africa very little research was devoted to food crops as compared to cash crops intended for export (*ibid.*: 26).

The Kenya Flat white was developed through self-pollination from the varieties brought in by early settlers from South Africa (Acland 1971:12-6). The variety is best suited to highland climates and to altitudes between 900 and 2,300 metres (*ibid.*). The initial objective of the breeding programme was to increase the yields of maize varieties already present in Kenya and this work focused a great deal on the highland areas surrounding the research station situated in Kitale. The programme developed rapidly and was extended after a few years to include also early maturing maize suited for the drier lowland areas. This work was started in 1957 at the Katumani research station in Eastern Province (Ogada 1969: 8).

In the Kitale research station work progressed and in 1959 germplasm was brought from different Central American sources. The introduction of these new genetic lines into the programme led in 1961 to a variety called Kitale synthetic II, which was commercially released (*ibid.*: 5). From this first synthetic variety, the programme developed further and in 1964 the first classical hybrid was released. This first hybrid had a yield potential advantage of at least 30

per cent over the Kitale Synthetic II. In the initial breeding programme the intention was to develop both synthetic and hybrid varieties since it was believed that small-scale farmers would not be prepared to buy seeds every year. Due to the yield advantage of hybrid seed, however, it became more or less impossible to sell synthetic varieties after 1964 (Harrison quoted in Gerhart 1975: 4). The breeding programmes therefore shifted more and more towards hybrids. This shift was certainly strengthened by trials held in Kenya indicating that hybrids planted under 'traditional' husbandry conditions increased production by 35%, and hybrids plus improved husbandry and fertiliser application raised returns by 300% or even more (Agricultural Input Review/World Bank, 1985), Vol. 1. Main Report, Chapter II.). It is widely accepted in agronomic circles that yields from hybrid maize are approx. 30% higher than from local varieties. This image, however, is increasingly contested as we will see in the next chapter.

The basic theory behind the production of hybrid maize 'is that by selecting certain maize plant types and carrying out crosses in a pre-determined manner, it is possible to add together the good points of the parent plant types. When these good points are all present in the final hybrid plant, the effect is found to be much greater than the sum of the individual desirable characteristics' (Stages and procedures in hybrid maize production, KARI training course on seed technology, Kakamega, August 1997).

The production of hybrid maize seed is a four-year process, which is conducted in Kenya as follows: In the first year the individual maize plant to be used for crossing is selected from inbred lines and self-pollinated. In this way, the number of genes are the same on both sets of chromosomes, which increases, and when all genes are identical for both chromosomes, the variety is said to be homozygous. In practice, the self pollinating is done by covering maize tassels with bags before anthers are ripe, and later collecting mature grains and fertilises receptive silks of the same plant. Each cob of shelled seed is harvested in separate packets and the product is called breeder seed. In the second year, the harvested seed are planted in separate rows in order to multiply the breeder seed. To avoid contamination with unwanted pollen from elsewhere, an isolation zone of 1000 metres is used. During the third year, controlled crossing of two inbred lines are carried out (foundation seed or single cross hybrid). The two parent seeds are planted in alternating lines and the tassels are removed from one line so that pollens do pollination from the second line. The isolation zone required is 400 metres. The fourth year is the final stage of the process of producing hybrid seeds. Foundation seed is crossed with either breeder seed (three-way cross hybrid), i.e.  $[A \times B] \times C$ , or with another foundation (double-cross hybrid), i.e.  $[A \times B] \times [C \times D]$ . The resulting

hybrid maize is then sold, after packaging, to stockists and traders ready for the producers to plant by the fifth year.<sup>8</sup>

In the process of crossing, deliberate selections are made of the inbred lines for the particular qualities one would like to have in the final hybrid. In making this selection it is possible to create seed varieties adapted to specific environments. A primary focus of the breeding programme was to adapt seed varieties to the wide differences in altitude and subsequently, differences in rainfall and temperature. All hybrids bred in Kenya are identified by three numbers. The first indicates the approximate altitude at which the crop has been bred: 6 for Kitale at 6,000 ft and 5 for Embu at 5,000 ft. The second number indicates the type of hybrid: 1 for a varietal hybrid (when a variety is used as one of the parents); 2 and 3 for classical hybrids (when inbred lines are used as the parents). 2 is used for double crosses, e.g. (GxD)x(AxF), and 3 is used for three-way crosses, e.g. (FxG)xG. The last number is a series number, sometimes followed by a letter, which also denotes the series.

Commercial production of F1 hybrid seed began in the early 1930s in the United States and developed quite rapidly. In 1913 the area of hybrid maize in the USA was only about 0.4%, and in 1956 about 98%. This success made the USA the biggest maize producer and exporter in the world both by volume and value (Song 1998: 79, see also Kloppenburg, 1988). Following its wide adoption in the USA during the 1940s, hybrid maize spread quickly throughout the developed countries, and also aroused interest in the developing world. However, the results in most developing countries were not good, with a few exceptions, such as in Zimbabwe, Kenya and the northern part of China in environmentally favoured areas (Song, 1998: 79). The spread of hybrid maize to the so-called Third World, along with the institutional framework in which it is embedded, is known as *The Green Revolution*.

Since the release of the first hybrids, the programme has further developed into breeding not only classical hybrids but also composites. The specific purpose of the latter programme is to retain a greater amount of genetic

---

<sup>8</sup> Selection of synthetic varieties is done differently. These are formed from a large number of inbred lines and have a greater genetic variability, are not faced with the same restrictions concerning the need to purchase seed every year (*ibid.*: 5). A development from the classical hybrids are the composite varieties, varietal crosses, with the intention of retaining a larger genetic variability than that found in the classical hybrids. Composite varieties may be crosses of classical hybrids, crosses between hybrid and synthetic varieties or hybrid crosses with single inbred lines. These are also less sensitive to yield reductions in subsequent generations, but preferably, new seed should be purchased every year in the composite varieties (*ibid.*: 6). Again it is obvious, that above all other factors affecting adoption, the genetic characteristics of the improved seeds will have consequences for the farmers and suppliers and thus influence adoption.

variability in the seeds than in the more classical hybrids. In the words of Ogada the problem of classical hybrids is: *'...once the hybrids are produced there is not then much hope to increase their yields because the final product has no more genetic variability left in it to produce for any scope for selection'* (Ogada 1969: 7).

A breakthrough was also achieved in the Early Maturing Programme started in 1957. In 1966 a variety called Katumani Composite A was released. In the programme it was deemed unfeasible to develop hybrid varieties for the lowland areas in which Katumani seed was to be used. The composite varieties developed are synthetic/synthetic crosses (cf. Ogada 1969: 5, Rundquist 1984: 93).

With the success of the breeding programme and with the purpose of obtaining high quality seeds for all major ecological areas in Kenya a third breeding programme was launched in 1965. This was the programme to develop Medium Maturity Embu types and the early maturity Katumani types. Again, this work was successful and by 1967 it was possible to release Hybrid 511, which had a 24 percent yield advantage over the locally grown varieties and the same maturity length (Ogada 1969: 8).

The three programmes covered most of the maize producing areas in Kenya with the exception of the coast. This was the most difficult for which to breed an improved variety and it was not until 1973 that a composite variety, Coast Composite X-105, was released. Having produced the first hybrid and composite varieties, the breeding programme has continued and is now producing double-cross and/or three-way cross hybrids from the varieties earlier developed (*ibid.*: 8). The programme has also been geared into breeding high lysine maize, which from a nutritional point of view could be very important. This latter type of work has been ongoing since 1966 in Kitale and has also been incorporated into the programmes of Katumani and Embu (Rundquist 1984:93). Initial progress was evident in this programme until 1970, but no more recent information has been found, however, to indicate that specific high lysine varieties have been released onto the Kenyan seed market.

The major breakthroughs made in the 1960s are no longer to be expected. The present targets are set at increasing yields by about 4 percent per annum through genetic improvement. An emphasis will also be placed on short-maturing varieties suited to double-cropping systems as well as developing varieties suited for inter-cropping. KARI recommends H622 for long rainy season use and H512 for the short rainy season in Siaya (KARI Annual Report 1996).

Changes at the institutional level, instigated by structural adjustment programmes and the neo-liberal discourse of privatisation and trade liberalisation, transformed the institutional landscape but not the R&D

orientation of Kenya's major research institutions. The Kenya Seed Company, once the main instrument of the State in the process of modernisation, is now a private company that has to satisfy its shareholders. Breeding hybrids for any market is now even more important than before. This resulted, among other things, in the termination of the (re) production of the Katumani Composites.<sup>9</sup> In addition, trade liberalisation deprived the KSC of its monopoly position. Other seed companies (e.g. from South Africa and the United States) are now selling hybrid maize on the Kenyan seed market. This in turn has resulted in a wide range of hybrids like PAN 5195 and PH1 flowing to Kenya's rural areas.

A recent innovation in the institutional landscape of maize breeding is in the activities of a small private seed company, Lagrotech (Lowland Agricultural Technologies). Lagrotech released the *Maseno Double Cobber* (MDC) in 1996. The company was launched by a group of plant breeders in the region after they realised that farmers in the lowland areas of Kenya were no longer keen on hybrid maize. Lagrotech set out to develop a composite variety of maize that is high yielding but requires low inputs. Starting from local land races such as the *Hamisi Double Cobber* - a farmer improved local variety from the neighbouring Vihiga District - Lagrotech developed the MDC. The MDC is high yielding and produces two cobs with few commoditised inputs. However, Lagrotech also recommends the use of inorganic fertilisers. Farmers can regenerate the seeds up to the third filial generation beyond which yield starts to decline. Lagrotech packages the MDC in 2-kg polythene packets and sells it to farmers at much lower prices than the hybrid varieties. The MDC is in fact Lagrotech's response to the phenomena that hybrid maize is not widely grown and no longer preferred in the region. Between 1996 and 1998, farmers were enthusiastic about the variety, but they discovered that its yield declines as they continue to reproduce it. Thus although they feel it is a better option than the normal hybrid, as it requires little inputs, they continue to look for more stable local varieties whose yields do not decline over time.

Research on how to develop the MDC further is still ongoing. The Kenya Plant Health Inspectorate Services (KEPHIS) whose mandate it is to test new cultivars of commercial seed for release in Kenya, does not test Lagrotech seeds and argues that the MDC should not even be in the market in the first place. However, the principal researcher of Lagrotech believes that '*the proof of the pudding is in the eating*'. He argues therefore that

*'researchers who claim that their work is relevant for improvement of agriculture in the tropics should be given the obligation and the opportunity to test their ideas and put them into practice. It is on this basis that Lagrotech tries to come up with a maize variety that will be acceptable to my people.'*

---

<sup>9</sup> Personal Communication Managing Director KSC, June 1998.

The Lagrotech's emergence as a private seed company was from the need to develop an open pollinated variety of maize MDC that would be more acceptable to farmers than classical hybrids and it thus represents what I have referred to as technological change from within.

### **Intervention and initial adoption of hybrid maize in Siaya**

With the package and institutional arrangements as visible outcomes of the breeding programmes of the R&D institutions in Kenya that focussed more and more on hybrids, to its disposal, the Kenya government initiated in the 1960s a national development programme aimed at an increase in the productivity of land and labour in maize cultivation. This programme consisted of the dissemination of the package through extension programmes, credit facilities, facilitating the purchase of maize by the responsible marketing board and private traders. Generally, the impact of hybridisation of maize has been appraised as positive. For example, Gerhart (1976: 56) concludes that 'although it is the combined package of practices (i.e., time of planting, good husbandry methods,) that produces the most dramatic results, the use of hybrid seeds alone will raise yields substantially, probably as much as 50% under good conditions.'

The presentation of the package through extensionists and extension programmes revolves around a set of nine recommended practices. A leaflet describing these is included in every package of hybrid maize seed. The practices recommended as ideal are presented in Table 4.2 below.

KARI Kakamega Regional Research Centre recommends H622 and H614 for farmers in Siaya during the long rainy season. Others that are recommended but not commonly grown in Siaya are H625 and H626. For the short rainy season KARI mostly recommends H512 and sometimes H511. The recommended spacing is 75cm by 30cm or 60cm by 30cm depending on the soil moisture content (KARI Annual Report 1996).

Table 4.3. below shows the varieties recommended for Siaya according agro-ecological zones.<sup>10</sup>

---

<sup>10</sup> These agro-ecological zones are defined by Jaetzold and Schmidt (1983) and are based on altitude, rainfall and to a lesser extent on soil quality. Dividing Kenya's regions in agro-ecological zones served the purpose of informing extension agencies to properly advice farmers what kind of crops to plant.



**Table 4.2. The prescribed hybrid maize technology package**

1.	Land Preparation: this should be made well in advance of planting and ensure a ready seedbed clean of weeds at the onset of the rains.
2.	Time of planting: this should be made at the beginning of the rains, or shortly before.
3.	Choice of hybrid: the right hybrid variety with respect to altitude and rainfall should be chosen.
4.	Population and spacing: a high, but not excessively high number of plants should be grown, this is achieved if planting is made in rows. The spacing depends on the place where the crop is grown.
5.	Planting: two seeds should be placed in every hole and a later thinning should be made when the plants are 15 to 20 cm high. The seed rate should be 10 kg per acre.
6.	Fertilisers: should be used twice; at planting time when the farmer is required to apply 50kg of Di-ammonium phosphate fertiliser per acre and when the plants are at knee high after weeding when he should again apply nitrogen fertiliser at the rate of 50kg per acre.
7.	Weeding: in addition to having a clean seed-bed early weeding is recommended and weeding should be a continuous process keeping the fields clear of weeds until the maize flowers;
8.	Stalkborer protection: to prevent stalkborers (an insect attacking the maize) insecticides should be used on the growing maize;
9.	Storage treatment against weevils: it is recommended that insecticides be applied to the harvested cobs before they are stored to reduce storage losses'.

Source: KSC instruction leaflet (in: Acland, 1971)

**Table 4.3 Recommended hybrid varieties of maize per agro-ecological zone by KARI**

Hybrid maize type	Northern Siaya		Central Siaya		Southern Siaya	
	Long Rains	Short Rains	Long Rains	Short Rains	Long rains	Short Rains
H626	X	*	*	*	*	*
H625	X	*	*	*	*	*
H622	X	*	X	*	*	*
H614	X	*	X	*	*	*
H512	*	X	*	*	X	*
H511	*	X	*	X	X	*

X: Very suitable

\*: Less suitable

Source: KARI, Kakamega

The first dimension of the spread of hybrid maize in Luoland is the environment that was created to facilitate its spread in the region and the country at large. The Kenyan government launched an aggressive campaign through KARL, MOALD and the then parastatals such as KSC and Kenya Farmers Association (KFA) to recruit and convince as many farmers as possible to grow hybrid maize. The research stations were given the task of developing high yielding varieties and the Kenya Seed Company (KSC) was made responsible for multiplying the hybrid seed. The Kenya Farmers Association (KFA), as a wholesaler, had to distribute the hybrid seed and inputs that go along with it, such as fertiliser and pesticides. The KFA distributed hybrid seed via a dense and efficient network of over a thousand licensed stockists, in Western Kenya. The strategy used was that every stage of the chain, from factory to wholesaler, to stockist, received a larger share of the profit. Those profits provided incentives to sell as much as possible, which made every stockist an extension worker (Gerhart 1976: 9). For instance, Selina Okeyo, a farmer from Nyamninia village (see genealogy, case 5, Chap. 3) stated that she got the advice to grow certain hybrid maize varieties from a KFA stockist.

George, who has been an extension officer with the MOALD since 1968, recalls the early period of the hybridisation campaign in Kenya when MOALD played an important role in the dissemination of hybrid maize among farmers. They had a mandate to recruit as many farmers as possible in their areas of operation. Contacts with farmers were made in many different ways. George had ten contact farmers to meet every week in his area of operation. In each season he had to organise field demonstrations in all contact farmers' plots. This way he could teach most farmers how to apply the prescribed hybrid maize technology package. When the yields were ready they could see for themselves the benefits of growing hybrid maize. He also had to pay individual visits to newly recruited farmers and help them with planting and the logistics of how to acquire seeds, fertilisers and pesticides. Every year George successfully organised a major field day in one of his best contact farmer's fields, which was attended by senior government officials from the district and the division. They were supposed to throw their weight behind the extension workers in promoting government policies concerning hybrid maize. It was also during field days that KSC field officers would come to meet the farmers and to sell their seeds. A farmer from Nyamninia, Margaret Odera (case 7, Chapter 3) recalls that during those field days they could buy hybrid maize at a price cheaper than at the farm stockists' stores. This made for a large turn out on the field days. According to George, his contact farmers were to spread the hybrid maize message to other farmers in their area, for as he comments,

*'farmers learn more from other farmers than from extension workers. Often when you visit a farm, other farmers are afraid to come. Immediately you leave they will approach the farmer to ask what you came to do. So you must try as an extension officer to reach those farmers that are central within a community so that others can learn from them.'*

Another method extension workers often employed was the use of opinion leaders. For instance George stated that he frequently approached church leaders in the region since their adoption of hybrid maize often had a positive effect on the adoption rate of their followers. Further, other government officials, such as chiefs and assistant-chiefs would promote hybrid maize at *baraza's* (public meetings), within a location or sub-location, where information about topical subjects and current events was exchanged. Teachers in primary and secondary schools also popularised the growth of hybrid maize through young farmers club.

Jaduong Patrick Odongo (80 years old) a retired primary school teacher, while headmaster of Muhanda primary school, encouraged the uptake of hybrid maize by allocating each class a plot to grow the crop. Each class was required to apply all the techniques prescribed in the hybrid maize technology package. Villagers used to admire the school plots and this gave them a positive attitude towards hybrid maize. The students also urged their parents to grow hybrid maize.

MOALD organised agricultural shows where exhibits from the farms were displayed. George was always in charge of his division's stand at the agricultural show ground. He would display there the best exhibits from his best farmers and won several awards this way. Some of his farmers used to visit his stand to learn more, and were thus motivated to continue planting hybrid maize. There were annual training courses for farmers at Farmers Training Centres (FTC's). Farmers would be taken to the centres for a week, where they were taught about the virtues of and the right way to practise hybrid maize cultivation. Extension workers could recommend farmers who had adopted hybrid maize, or were potential adopters, for a course at a FTC.

This promotion of hybrid maize did not solely consist of emphasising the virtues of hybrid maize, it meant that extension workers gave insufficient time to local maize, especially types like local yellow and local red, and other food crops like sorghum, finger millet and cassava. These local crops therefore came to be known as poor man's crops. They were associated with backwardness and ignorance. Hybrid maize (which was all white coloured) was associated with modernity and being progressive.

Another factor that contributed to the uptake of hybrid maize in Siaya was the early exposure to it by migrant workers on white settler farms, who thus associated it with modernity and civilisation. One's status in the society was held in high esteem if you planted hybrids.

For instance Abednego Ochieng (case 1 Chap. 3) was born in 1950 in Kitale (Trans Nzoia district), a region well known as the granary of Kenya. His father was working for the Hughes Company as a mechanic. Around Kitale he saw hybrid maize for the first time. He explained,

*'I started serious farming in 1972 after completing secondary school. Before that, I tried teaching as an untrained teacher in a primary school but the pay was so low that I later abandoned it. During this time the campaign for growing hybrid maize was at its peak. So I started straight away with hybrid maize. This is because after seeing its performance in Kitale and also having developed interest in agriculture during my school days in Nyangori, very close to maize growing areas of Nandi district, I went to the divisional agricultural office and told them my plans. The then locational extension officer Mr. Wasao very quickly organised a tractor for me and I had my plot dug for free. He issued us with a bag of fertiliser and 10 kg bag of H632. During those days we were being offered such farm inputs free'.*

With the strong backing of extension officers from the Ministry of Agriculture who could supply farm inputs for free, Abednego became a very successful farmer in Muhanda village. He became a contact farmer and his farm was used for the rest of the 1970s as a demonstration plot for all farmers in Muhanda village. He won various awards as the best farmer at district and provincial level.

The tractor help, the fertiliser and hybrid maize seeds, were all received in 1974. In 1975, with the assistance of the Provincial Agricultural Officer, he was given a loan from Agriculture Finance Corporation to buy exotic dairy cows. The barbed wire fencing for his paddocks and a stir-up pump for spraying the animals against ticks were also given free. To motivate him further, he was given help with most of the work on his farm. Students from Bukura Agricultural College and Egerton Agricultural College were consigned to his farm during their field practical period. In 1976 he was selected by the Provincial Agricultural Officer to join farmers from other provinces of Kenya for a field visit to Zimbabwe, where he met farmers from South Africa from whom he learnt a lot about hybrid maize. He also saw what Zimbabwean farmers were doing in their fields. This motivated him to work harder in his farm. Abednego never repaid the loan from the Agricultural Finance Corporation. According to him, he did not request the loan. However he is still being asked to pay it back.

The combination of the earlier mentioned factors, the seed distribution system, hybrid maize promotion, out-migration and subsequent encounters with hybrid maize cultivation, all resulted in a second important reason for the uptake of maize, namely, the emergence of a pro-hybrid maize attitude.<sup>11</sup> This

<sup>11</sup> In Yala it became almost a taboo to provide visitors with *ugali* made from yellow maize or sorghum. As many people stated, women from Yala who married men from the South of Siaya, where more sorghum and local maize were grown, were often considered to be difficult

change in attitude facilitated adoption, and resulted in what can be understood as the second stage of the maize penetration of Siaya District. You were considered to be of a higher social status if you grew hybrid maize.

A third reason for the uptake of hybrid maize was the offer of fertiliser subsidies and the offer by government tractor services in the 1960s and early 1970s to plough fields for free. Kenya has a long history of high levels of fertiliser subsidy (usually above 80%), going back to the 1950s (Gerhart, 1975: 11). In spite of the subsidy, fertiliser was not widely used until the adoption of hybrid maize. From that time farmers have paid prices well above the 'official price', but substantially below unsubsidised prices. This high level of subsidy also contributed to fertiliser supply problems, as a result of which farmers were unable to get as much fertiliser as they wanted at the right time. This did not prevent its widespread use, indicating that when the returns to fertiliser were high, farmers were willing to expand much time and effort to obtain it. In spite of supply problems, the subsidy undoubtedly assisted the adoption and expansion of maize.

According to George, farmers did not however totally abandon traditional crops. He explained how they grew them behind their houses and in small fields.

*'...sorghum was still there, it was not completely abandoned. Mainly because hybrid maize is not suitable for brewing the local beer, busaa. After the coming ... of Christianity drinking busaa became problematic and this decreased the growth of sorghum. But for ugali, people in Gem (northern Siaya) turned to maize. But if you go to the south of Siaya still many people eat ugali from sorghum. Further, the government did not introduce hybrid maize for the farmers alone. It also had its own interests. It wanted to generate income for itself. The government also introduced hybrid maize for commercial purposes. The government sent out its own agents to buy the maize, NCPB, creating a market for maize. They did not do the same for sorghum because sorghum could not be sold outside Kenya and is also difficult within parts of Kenya. Although sorghum is much more adjusted to local circumstances in the south of Siaya, maize was still promoted there.'*

Extension workers sometimes also gave hybrid maize seed or fertilisers free for demonstration plots, also 'extension loans'. Yiengo Rateng, from Muhanda, went for such an extension loan in 1976, which meant he had his land ploughed, received hybrid maize seed and a bag of DAP fertiliser, and assistance with line sowing, 'free'. Later he was also issued with a bag of CAN fertiliser and helped to top-dress his maize i.e. applying fertiliser on top of the soil around the root zone of maize plants. When the harvest was in, the extension workers would collect two bags of maize as loan repayment. These extension loans were terminated in 1978 (District Annual Report, 1978: 14).

---

in their new homes because they were reluctant to prepare and eat sorghum or local maize ugali.

A fourth reason why farmers took up hybrid maize was its profitability. The six households mentioned earlier as still growing hybrid maize, all claimed that its cultivation was still profitable. The average yields gap between hybrid and local maize was wide enough to finance the inputs and still make a profit. This was helped by the proximity of the National Cereals and Produce Board (NCPB) depot in Yala town, some 6 km from their villages, which offered ready market for their maize. From 1942 onwards the NCPB maintained guaranteed minimum prices for maize, which decreased the risks involved in the costs of growing it (Gerhart 1976: 14-15). This has changed. Recent neo-liberal discourse had reduced substantially the role of the NCPB's and private traders nowadays operate freely on the market.<sup>12</sup>

Jaduong James Wasawo, a retired extension officer, adds a fifth point, spelling out why farmers took up hybrid maize. He served as a government extension worker for 34 years. According to him, at the time hybrid maize was being introduced, traditional cash crops such as groundnuts, cotton and sugar, were plagued by marketing problems, largely because of inefficient marketing boards. Farmers were reluctant to expand production of these crops. Sorghum and millet were mainly for home consumption and were not sufficiently profitable to be marketed in substantial quantities. Thus as Jaduong Wasawo states,

*'The introduction of hybrid maize provided farmers with a highly profitable enterprise and the NCPB offered a ready market for it. Furthermore the NCPB has a depot in Yala town. Where the depot is situated was initially a marketing centre established in 1908. The arrival of the railway line in Yala in 1935 made this marketing centre expand culminating in the Maize Marketing Board in 1942. The NCPB inherited it later in the 1960s.'*

He recalled that by the late 1970s, hybrid maize was far more profitable than any of the traditional crops. From farmers' information, he calculated that the net margin per hectare of hybrid maize was six times the net margin for the traditional sorghum and millet food crop mixture. Maize was seven times as profitable as the traditional crop cotton, and more than three times as profitable as sorghum inter-cropped with cotton. These higher returns per hectare were attractive in a situation where increasing land scarcity made it important to increase the returns on land. There were two major factors contributing to its greater profitability: first, the high yields of fertilised hybrid maize; and second, the fertiliser subsidy, which favoured hybrid maize over other crops because of its high level of responsiveness to fertiliser. The increased profitability was not caused by favourable output price for maize. Throughout this period changes in the price of maize remained comparable to

---

<sup>12</sup> Although the evidence is not there yet, I strongly believe that the present maize consumption market is chaotic and characterised by price fluctuations.

that of competing crops. Another important feature Wasawo mentioned was that besides being a cash crop,

*'maize was also a food crop, and therefore could be stored for consumption purposes if there were marketing problems. Maize, in addition, matured about a month and a half earlier than sorghum. This made it possible for farmers to sell stored maize to finance inputs at the beginning of the growing season, because a new maize harvest would soon be available to replenish their food stocks. While millet also matured early, its low yields made it unsuitable as a cash crop.'*

These advantages led to a spectacular increase in maize production, both for food and cash. Maize consumption increased rapidly in the north, where traditionally sorghum and millet had been dominant staples. The northern region also started exporting large quantities of maize to the population centres of the south, the local maize growing area. Improved road communications and the introduction of hybrid maize enabled the northern region to capitalise on their natural comparative advantage in maize production over the south.

However, despite these factors, it must be pointed out that in contrast to other areas in Western Kenya, the adoption rate of hybrid maize in Siaya district was never very high. In 1973, its uptake for the whole of Siaya was still below 20%, while in the same year districts like Trans Nzoia and Kakamega had reached an adoption rate of almost 100% (Gerhart 1976: 27). In other words most farmers in Siaya district decided not to adopt the hybrid maize package presented. Furthermore, farmers who adopted it, in most cases did not adopt the total package. They adjusted, or redesigned it in many different ways, as we will see in the next chapter.

However, since the villages where I carried out my research lie in the northern highlands of Siaya district, neighbouring Kakamega district in Western Province, with a slightly better climate for hybrid maize, the uptake was higher than that for Siaya district as a whole. Northern Siaya contributed to almost 80% of the hybrid maize growing areas in Siaya (District Annual report 1973: 8).

This story of the hybridisation of maize illustrates the proposition raised by Long (1986) that the farming population is an active agent of change. Siaya farmers actively integrated these new opportunities into their maize production practices. The adoption of hybrid varieties by farmers, i.e. a product of 'the environment', was remarkably fast in Kenya (Gerhart 1975) as a result of which traditional maize production, selection and distribution systems in some areas like Nandi and Uasin Gishu Districts have given way almost completely to hybrid maize production, testing and distribution systems (Hebinck 1990). However, in Luoland and in the Siaya region in particular the maize landscape was never transformed in such a dramatic way.

We will see in the next chapter that local maize is still widely bred, selected and grown.

### **Mass selection of local maize and hybrid maize breeding compared**

The two maize breeding and selection networks differ substantially from each other. This section narrates the different logic of the two breeding strategies.

A major point of difference is that yield of the (classical) hybrid drops in succeeding generations and in order to retain the yield advantage of hybrids fresh seed should be purchased for every planting season. If a grower uses second generation seed, the resulting population is very variable, owing to genetic segregation, and yields are poor. Thus, it is *not* possible to select seed from the previous harvests, which is the common practice in the use of local varieties. Hybrid maize seed production has to take place under specific and controlled circumstances. After packaging in certain quantities, the maize seed is distributed and ready for sale on the market. The farmer is thus compelled to enter market relations in order to obtain the maize seeds (as well as fertilisers and pesticides). Thus hybrid maize production presupposes the expansion of commodity relations in the labour process, and requires the efficient operation of institutions such as commodity markets, which is not always the case in the Siaya region. This is a first major difference with the mass selection and breeding practices that generate seeds that are (relatively) free, available and exchangeable.

A second difference with local maize breeding is that the hybrids come in the form of a package. In order to produce higher yields compared to local varieties, hybrid maize requires the application of bio-chemical inputs (fertilisers and preferably pesticides: see Table 4.2). Such inputs are more or less compulsory as hybrid maize is very sensitive to nitrogen shortage – and therefore responds well to fertiliser application –, and the vulnerability to pest attacks and the growth of weeds from heavy fertiliser input have also necessitated the use of pesticides and herbicides. Local maize varieties on the other hand do relatively well under stress conditions (lack of water, no fertiliser application) and are more resistant to drought and variable patterns of rainfall.

Another feature of hybrid maize is that it needs reliable rainfall patterns and relatively good soils. No rain, no good harvest. This is contrary to most local varieties that are generally more resistant to drought and variable patterns of rainfall. The Kitale Research Station estimated that for Western Kenya the crop yield is only 50% if sowing is delayed by 2 weeks. 70-80 kg grain/ha. are lost for each day's delay after the first week of the rains. The time of planting is thus crucial for reaching the inherent technological optimum of hybrid maize and in its turn is greatly influenced by the availability of labour. Correct



timing for land preparation and particularly for sowing is required to coincide with specific phases of rainfall. Seasonal labour peaks are thus intensified. Labour, its availability and the correct timing of its employment becomes a major determining factor in hybrid maize farming. Furthermore, it is crucial to note that the intensification of labour peaks requires the availability of either a (not necessarily free) agricultural labour force or of machines to resolve the constraints involved with the occurrence of labour peaks. Local maize is much more drought resistant than hybrids. Although labour is also a critical issue in relation to local maize production, the labour issue must be understood in the context of rural development and the livelihood strategies that people devise to eke out a living.

Accordingly, another major feature of the hybrid maize regime is its emphasis on the organisational and institutional arrangements for the production, import and distribution of inputs. Under the 'new strategy', importation of fertiliser was stepped up, arrangements were made for the multiplication of seeds and development of extension network and stockists, while large amounts of foreign aid was allocated for importing some of the inputs. The Kenya Farmers Association (KFA) was made responsible for distributing some of the inputs, and some were sold through private dealers. Since the new inputs were highly expensive, credit facilities were introduced through the Agricultural Finance Corporation (AFC) and the previously state owned commercial banks. With the increase in output going far beyond the subsistence needs of many producers, arrangements for marketing constituted as much a part of the package as any other component. The technology associated with the high-yielding varieties, popularly described as a 'green revolution' technology, is not merely a package of physical inputs, it also incorporates a package of new agricultural practices and institutional arrangements. The new technology follows a new crop calendar - given the longer maturing period of the new maize varieties; farmers are advised not to inter-crop with other food crops such as beans; and there are associated changes in the cropping pattern and crop rotation. Each of the 'new' inputs brings with it a new set of agricultural practices and recommendations. The farmer must now know how much seed to plant, how much fertiliser to apply on which type of soil, when, and in what proportion between nitrogen, phosphorus, and potash. Similarly, the farmer must understand which type of seed is vulnerable to which type of pest, and what the various options of pest control are with varying implications for timing in the use of chemicals, human labour, crop pattern and rotation. Farmers using mechanical equipment have to learn their use and maintenance. Maintaining relationships with research and extension and advice agencies plays thus an important role in the production of hybrid maize. The character of such relationships is such

that farming becomes increasingly embedded in, and shaped by commodity relations.

The local maize mass selection and breeding regime, on the other hand, is not embedded but rather distanced from such institutional arrangements and is predominantly shaped by non-commoditised relationships and the character of the local society and economy, elements of which were analysed in Chapter 3. The way the Luo breed, select, exchange and produce local maize varieties is largely fashioned by localised institutional arrangements such as *golo kodhi* and *dwoko cham*. Although they are sometimes contested, they remain part and parcel of the dynamics of such a socio-technical regime. It is also through these localised institutional arrangements that free exchange of knowledge among clan members and neighbours takes place.

A striking characteristic of Kenya's formal maize breeding programmes over the years is that the emphasis has gradually shifted from the collection of local or African genetic resources for selection and breeding purposes to the importation of exogenous genetic material. Over the 1964-1985 period, Kenya imported nearly 64% of all germplasm accessions for breeding programmes. The corresponding figure for cereals was 49% of all the accessions, while in the case of maize the figure for imported germplasm was as high as 88% (Juma, 1989: 184-185).<sup>13</sup> Juma comments that '*by emphasising increased food production as the main focus of breeding programmes Kenya has tended to drift towards a narrower genetic base in major commercial food crops*' (Ibid.: 190). This shift does not, however, reflect the preferences of the consumers, who as we will see in the following chapter, tend to opt for greater variability in their food resources as well as in taste and colour of varieties. Beans and local maize varieties have been gradually adapted to producers/consumers preferences since their introduction into East Africa. This kind of taste and colour preference and local knowledge about local varieties is generally not the kind of knowledge that informs R&D policy makers. The R&D industry in Kenya clearly follows a different path, as it is oriented towards monocultures, mechanisation and genetic uniformity, in stark contrast to the mass selection of local maize. The local ecology, farmers' fields and neighbouring Uganda are the most important gene pools for the selection, breeding and preservation of local maize. They represent a niche for the development of hidden novelties that float locally within the wider socio-technical landscape.

---

<sup>13</sup> Similar trends can be noted in forest and livestock species. In 1985 nearly 95% of Kenya's planted forests were exotic, and nearly 93% of the germ plasma used in artificial insemination programmes was from exotic dairy breeds (Ayrshire, Friesian, Guernsey and Jersey) (Juma, 1989: 184-186). The reduction of the genetic diversity of local livestock breeds was effectively undertaken in the colonial period, although ownership of graded cows was mainly restricted to the settler community (Cowen, 1974).

The hybrid maize regime is very distinct from the networks through which local maize proliferated in that it is the outcome of ongoing progress in the agrarian sciences, notably in plant breeding, production ecology, soil science, and agricultural engineering and economics. The development of a technology package consisting of hybrid maize, fertiliser and the application of biochemicals plus the image that hybrid maize is an economical crop to grow because it increases the returns to labour, are the most visible outcomes of this regime. Hybrid maize is further perceived as superior to local land races of maize because it out yields them. In other words, scientific knowledge (of breeding and selection) is imaged as superior to local knowledge, which then is or becomes superfluous. Together with a series of recommendations on how to apply the package, extension strategies to ensure adoption, credit facilities to ensure that farmers purchase the proper inputs, and the formation of particular markets for inputs and output, this technology package represents a new socio-technical regime increasingly prescribing and shaping agricultural development in such a way that it operates within the domain spanned by markets and technology supply. The starting point has always been the technological superiority of hybrids over local varieties. It may be questioned, however, whether hybrid maize varieties really produce higher yields than local varieties, and likewise whether they have contributed to an increase of food security at household level. Greer and Thorbecke (1986) already advanced this issue in the mid-1980s. Characteristic for such a regime is the externalisation and institutionalisation of farm related tasks in specific institutions such as seed companies, financial institutions such as banks, extension services and advice, marketing bodies, seed quality control centres, and input distributors. The development of such a technological regime is (or was) the product of a project implemented by the state apparatus enrolled and supported by foreign aid relationships. It has become, since the 1960's, the cornerstone of the agricultural policies of the state with a view to increasing productivity and food production for the nation and to attaining national food self-sufficiency (Hebinck, 1990: 209 ff.; National Food Policy paper, 1981: 1<sup>14</sup>). The mass selection of local maize in contrast hinges on a socio-technical regime of local knowledge, and is a project intrinsically embedded in and regulated by locally specific cultural repertoires and social relationships. Cross border trade and exchange among kin and neighbours characterise its proliferation

---

<sup>14</sup> Later versions of the National Food Policy paper (1994) echo the same ideas and images. The institutional framework has, however, changed dramatically due to privatisation and trade liberalisation. The KSC was once a major vehicle for the state for the implementation of its food policy; nowadays KSC is a private company that serves the interests of its major shareholders.

practices. Preservation and (re) production is shaped and characterised by non-commoditised relationships and the character of the local economy such as exchange of labour (through *saga*, local exchange of seeds and inputs, and food).

The hybrid maize socio-technical regime may thus be conceptualised as an intervention, as a planned transformation of 'traditional' maize production systems towards a 'modern' hybrid maize seed production, selection and distribution systems (i.e. induced innovation). Hybridisation presupposes the transformation of the labour process and in particular the objects of labour, and simultaneously the integration of peasant production of maize (and other crops) in commodity markets. Commoditisation is locked into the concept of hybridisation. Local maize breeding and production on the other hand represents technological change and development 'from below', a project carried forward by local people themselves. It represents a development process characterised by increasing 'distancing' from 'formal' or 'modern' institutions rather than 'interlocking' (see also next chapter). It also represents a social process that over the years has internalised exogenous resources in such a way that both the meanings and the resources were transformed into endogenous resources.

The specific agronomic nature of the 'miracle' seeds and the characteristics of the social structures into which they were introduced, led some researchers to argue that only the already well off farmers would be able to adopt them. It would lead to rich farmers getting richer and the poor getting poorer and losing their land since rich farmers tend to have better access to wage labour, agricultural credit and off-farm income (cf. Röling et.al 1976: 63 ff., see also Melkote 1988, Griffin 1979, and Hebinck 1990).

### **Characteristics of maize**

Hybrid maize selected and bred by plant breeders in specific locations and institutions such as laboratories and experimental stations, obviously generates a different seed from that resulting from mass selection by farmers on farmers' fields. I begin with a phenotypic description of the characteristics of local maize varieties currently grown in Luoland in general and in the Siaya region in particular. I will characterise the hybrids that are known to farmers and plant breeders and which are available on the markets in the region.

#### *Characteristics of local maize varieties*

There are several local varieties of maize planted in the research villages studied, but here I will deal only with the most common. This is because although farmers mentioned several varieties, I managed physically to see only some of these. Earlier I mentioned that the first variety of maize grown in

Siaya was *rachich* and *radier* (the local multicoloured varieties). The Europeans then introduced the local white, followed by local yellow, with Uganda white coming in last in 1982-84.

I will start by discussing local white varieties commonly known as *rachar*. Within this variety, there are many other cultivars, *Oking*, literally meaning 'hard' in *Dholuo*, being one of them. *Oking* is characterised by a whiter grain than other local white varieties, and it performs relatively well on infertile soils. It matures in about 100 days. *Oking* has medium yield potential. Its spindle has 14-16 lines filled with grains. *Ababari*, another local white variety, can yield much higher. The name *ababari*, according to farmers, means robust seeds or seeds bigger than the normal ones. This variety is capable of producing cobs as big as those of hybrid maize. However, it also needs fertile soils to produce well. Furthermore it can take 120 days or more to mature. Its characteristics thus tend towards those of hybrid maize. Its spindle has few lines (8-12) with big grains. Other local white varieties of maize are Uganda white and *Kawanda*, which are sometimes known as 'border-border' for obvious reasons. Uganda white has white grains but the spindle is red. The spindle can also be white but at the tip where the grains are attached, it is red. The spindle contains 20-22 lines of grains. It is high yielding, like *Ababari*. *Kawanda* also came from Uganda. It has white grains, which produces very white flour and is the reason why farmers prefer it. Its spindle is dark red and its stalk also. Because of this complexion, its leaves are dark green with a dark red colour on the background. *Kawanda* has 18-20 lines of grains on its spindle. Both Uganda white and *Kawanda* take between 100-120 days to mature. The next white variety is the 'zero-type', a family seed of the Okatch family in Nyamnia. This variety is very high yielding, like hybrid maize. It needs some farmyard manure to realise its yield potential. It matures within 120 days and has between 14-16 lines in its spindle with big grains. There are also other white cultivars of local maize that I shall not discuss here because, although mentioned by farmers, they were not as common. Most white varieties of local maize take about 100-120 days to mature. They have good taste and are therefore very popular with farmers. They do not suffer as much bird damage as hybrid maize varieties, since their cobs do not open up when mature. In some cases, the cobs droop downwards so water cannot enter when it rains. This characteristic allows them to stay in the field and remain dry while still attached to the maize stalk, with a very low moisture percentage of 15-18%. They are able to tolerate sudden weather changes.

The second set of local maize varieties is the multicoloured. Like local white, within this variety there are several multicoloured cultivars. Farmers identified three main cultivars, *Radier*, *rachich* and *rapir*. *Radier* has a cob filled with mostly white grains with a few red grains scattered in between. *Rachich*

has white grains with a few dark purple grains or dark purple grains with a few white grains on the cob. *Rapir* has white grains with red stripes cutting across them. The yield potential of the multicoloured varieties is very close to that of *Oking* – that is, low to medium. They are hardy, drought resistant, can resist sudden weather changes, can give some yield (though not high) in soils with low fertility, are not liked by birds and take between 100-110 days to mature.

Local yellow, commonly known as *nyamula* is the third local variety. Earlier I mentioned that local yellow was introduced in Siaya around 1928-1930 from America. It was brought as relief food following the great famine that took place in Siaya after the locust attack. This variety of maize is early maturing. It takes a minimum of 90 days to mature and is liked by farmers as it relieves them from hunger earlier than the other varieties. Local yellow does relatively well in infertile soils and needs less inputs than local white. It is drought resistant and can resist sudden weather changes. The grains are flint hard and are not seriously damaged by pests as compared to hybrid. Local Red, which has characteristics similar to those of local yellow, has the added advantage of being tastier. However, its yields are relatively low as compared to local yellow. Local black is the earliest maturing variety. It takes 70-90 days to mature. It is very low yielding, but *Ugali* made from its flour is as heavy as that of sorghum. It also does well in infertile soil. It is very resistant to pest attack and is capable of evading drought. It also has very good brewing qualities.

This presentation of the local varieties encountered in Siaya district is by no means exhaustive. It is only meant to give an impression of the range of local maize varieties. No doubt farmers can identify many more local varieties, such as the different types of local yellow maize or other types of local white. However, it should also be stated that farmers do not always agree upon the name of a local maize variety. For instance Yiengo Rateng said that he acquired the *ababari* that he presently grows in 1985 from Selina Okeyo. Selina Okeyo herself stated that she started growing *ababari* in 1995, when she got the seed from her friend, Margaret Odera. This perhaps indicates that Yiengo Rateng has a different idea of what *ababari* is, or maybe one or other gave a wrong date. These differences of opinion on the identity of certain varieties of maize result from the continuous cross-pollination that occurs between different varieties. For instance when *oking* and *ababari* are grown on small plots, next to each other, then the seed produced on the two plots has characteristics of both varieties.

The introduction of hybrid varieties of maize from the early sixties onwards further increased diversity. This occurred because of the cross-pollination of local and hybrid varieties of maize. For that reason certain local maize varieties

nowadays share the characteristics of hybrid maize. These varieties are not very stable and often confuse farmers who then try to reproduce them as local seed. Normally the outcome is reduced yield. The import and crossing of hybrid maize characteristics is further facilitated by the fact that many farmers nowadays sow maize that has been bought in the market. This occurs when farmers fail to select enough cobs for future seed for all their fields from the harvest and when yields have been so low that the stores are sold out before the next planting season starts. This happened to Gladys Awiti who in the short rainy season of 1996 completed planting with white maize that she bought in Muhanda market. This maize is often referred to as local white, but it is not an accurate description. Since the maize market was liberalised in 1994 and the ban on private inter-district maize trade was lifted, Siaya district markets, such as Yala and Muhanda, have been supplied by traders with maize grown in hybrid maize areas such as Kitale in the Rift Valley Province. This maize is therefore first generation, or F1, hybrid, and thus shares many characteristics with hybrid maize, and through cross-pollination those characteristics are spread to other varieties as well. The foregoing already implies that as a result of enormous diversity the identification of local varieties of maize is extremely difficult. But this is especially so in the case of local white varieties since the colour of the maize reveals nothing about its origin, since hybrid maize is also white.

It can be concluded, then, that the diversity found within local varieties of maize is the result of continuous cross-pollination with other maize varieties. Their stability and sustainability within the Siaya ecology is attributed to both natural and human selection, and therefore adjustment to specific environmental circumstances within certain localities. It is also difficult to determine the spread of the different local varieties in the research villages and no such statistics exist. The common picture today is that more than two or three local varieties are cultivated in the same village or by the same household. It is in a way quite surprising that the varieties found in a village might easily be the same as the varieties found in the neighbouring village. A possible explanation is that trade in local maize is not limited to state generated market liberalisation. Traders go as far as Uganda to obtain local maize. The informal market has proved more effective than the formal market where hybrid maize dominates. Individual farm households, who through mass selection secure high gene variation, maintain plant populations.

#### *Characteristics of hybrids*

Since breeding has continued ever since the release of the first hybrid variety in the early sixties, many new hybrid varieties have been developed and released to date. These new varieties often performed better on certain

characteristics, such as on their yield potential or drought resistance, which led to their replacing older varieties. KARI no longer recommends H611 and H632 since other six series hybrids, - H626, H625, H614 and H622 - are performing better. The Six series hybrid varieties mature within six months. They demand high rainfall, though the H622 variety demands less. The so-called six series of hybrids have a higher yielding potential than the five series. The five series - H511 and H512 - demand less rainfall than six series and they mature within five months. The six series are considered the most suitable for the research area, since Yala Division, where the research villages are located, receives on average enough rainfall to realise their higher yielding potential. Below I give some individual characteristics of hybrid maize.

Hybrid 632 takes 180 days to mature and is one of the earliest arrivals (1971) of hybrid maize. According to farmers' and plant breeders' accounts, it is a high yielding variety, and produces two big cobs. However, it lodges quite easily when there is a strong wind and is unable to rise again. Furthermore, the cob of the H632 opens prematurely allowing water to enter, causing cob rot. Because the cobs open up before the grains are fully mature, it is also vulnerable to field pest attacks, particularly from birds.

Hybrid 627 takes between 180 to 200 days to mature, is a very high yielder but lodges easily. H627 is the highest yielder of all the 6 series hybrids, but it rots more easily because the cob opens and it stays longer in the field. Hybrid 626 is also a very high yielder, second to H627. Its cob opens but not as with H627. However, it lodges more than any other hybrid maize and starts rotting in the field before it is fully open if there is a lot of moisture during the ripening period. Hybrid 626 is no longer on the market because people complained it could not stand drought. H625 is better. It grows less tall and does not lodge or rot so much. However, it is unable to withstand even slight stress from a change in the weather. It yields slightly below H626.

Hybrid 622 lodges quite easily because it grows very tall. Farmers say that it is almost the sweetest hybrid. Its cob does not open much and it can thus reach physiological maturity with very little cob rot, but it opens sufficiently to allow pest attack, and the birds eat too much of it (this also goes for H632). Like all other hybrids where cobs open, storage pests like weevils attack it right from the field. Farmers also mention that because it lodges quite easily, other field pests such as rats, termites and mongoose attack it on the ground. It is also vulnerable to leaf rust and maize streak virus disease.

Hybrid 614 is both strong and lodges less. This is because it has prop roots up to the first node above the ground that give it strong support. It can withstand weather changes such as moisture stress or too much rain accompanied by strong wind. This is why it is popular with most farmers who go for hybrid maize. It yields slightly lower than the other six series hybrids,



according to farmers, and its cob does not open. However, like all other six series hybrids it stays longer in the field. Maturity period extends to up to 180 days. It has a flint type of grain that is very prone to weevil attack in the store.

Hybrid 512 yields lowest of the entire six series hybrid, it is drought resistant, and its cobs open only slightly in the field. It grows very tall and takes up to 150 days in the field. It is developed for semi arid areas. H 511 is also developed for semi arid areas. It is moderately high yielding but lower than 512. It can withstand drought and matures within 150 days. It does not grow very tall. H511 and H512 are sweeter than the six series hybrids according to Abednego, though less sweet than local maize.

Only one farmer, Ochieng Monye, in Muhanda village was growing Pannar (PAN 5195). He was trying it out on an experimental plot. Ochieng states that it matures within 120 days. It is not drought resistant, lodges easily as it grows very tall and is not as high a yielder as the six series hybrids. However, it yields more than five series hybrids. Like all other hybrids, it demands high inputs. Pioneer (PH1) hybrids are drought resistant, do not grow very tall but are high yielders. They demand high inputs.

The Maseno Double Cobber is a composite variety of maize developed locally by a private plant breeding company in Kisumu. It matures within 90 days, does not demand very high inputs, yields slightly higher than local maize and produces two cobs per plant. Its seeds can be regenerated up to the third filial generation when farmers have to buy new seeds. Farmers are still experimenting with it.

### **The dominance of local maize in peasant farmers' preferences.**

During discussions in the research villages, what emerged is that the majority of farmers grow local maize. Some mentioned that even farmers known to be hybrid maize adepts are moving away from it and going back to local maize. The reasons given all relate to the issue of the adaptability of the seed to local farming practices and to the overall socio-economic situation. In an attempt to verify this, I carried out a survey among 26 farmers selected at random in Muhanda, Nyamninia, and Muhoho villages. Early maturity, food security, pest resistance, palatability, tradition and lack of money to engage in hybrid maize cultivation were the major reasons farmers gave for preference of local over hybrid maize (Table 4.4).

**Table 4.4: Choice of local composite seed in Muhanda, Nyamninia and Muhoho Villages**

Reasons	Percentage	Number of Observations
Early maturity	23	6
Food security	16	6
Pest Resistance	7	2
Palatability	23	6
Tradition	19	5
No money to buy hybrid	12	3
Total	100	26

Source: Own surveys June 1998

The reasons of 'early maturity', 'food security' and 'pest resistance' are closely linked to the fact that, although these three villages are located in the high potential area of Siaya, cultivation for subsistence still plays a substantial role in household decision making. 'Palatability' is clearly linked to specific end-uses and 'tradition' is related to existing cropping practices. Local varieties are well adapted to the environment and to specific local methods of cultivation and end-use. The adaptation of local seeds to local conditions is primarily related to early maturity, sustainability under conditions of unstable rainfall, resistance to pests, ability to yield when cultivated even without fertilisation and specific consumption end-uses.

Farmers in Siaya identify and develop characteristics of local maize varieties that meet their own priorities. The adaptability of local seeds to local conditions therefore reflects the major priorities of the traditional household production strategy; i.e. minimising the utilisation of available resources and thus securing a sustainable year round food supply.

In the previous section, my analysis showed that most local maize varieties have a period of 85 to 120 days from planting to maturity, which is short in relation to hybrid varieties that take between 120 to 150 days. If planted at the beginning of the rainy season, local maize will mature while the rainy season is still at its height. This enables farmers to harvest the crop fresh, piecemeal, and as needed for household consumption. Local seeds play a crucial role in the traditional food system based on supply of fresh food year round.

In the semi-arid areas of Siaya, characterised by a short rainy season, local maize varieties constitute an important element in minimising the risk of total crop failure. Even if the rains stop early, local varieties will not be reduced as much as hybrids, and in such years, the yield of the local maize may easily

exceed that of hybrid. During my survey in the long rainy season of 1999, one farmer, Selina Okeyo concluded:

*'The variations in yield with time of planting are considerably higher for the hybrid than local maize and so it is more vulnerable to variations in rainfall pattern than local maize. In order to secure at least some production if the rains fail, I have deliberately not fully adopted the use of hybrid. This is why I combine a 'high risk but high yields' strategy with a 'high security but not maximum yields' strategy. Because of the higher risk of crop failure using hybrid maize, we farmers of this region, have decided to continue growing some local maize to ensure some food security'.*

Thus local maize shows high sustainability under unstable rainfall patterns. This is because of their high genetic variation. Acland (1971) describes the open-pollinated local maize composites grown in Kenya as seeds of 'higher variability and stability' than the hybrids and 'better adapted for cultivation under variable climatic conditions'.

If natural selection of composites has taken place in the development of local composites, the genotypes will adapt themselves to the total sum of environmental factors such as rainfall pattern, plant diseases etc. As such, they will perform better than the existing hybrids if adverse conditions occur. Most farmers interviewed confirm this. They clearly stated that the absence of rain in some years for a shorter period caused serious damage to the hybrids while having little effect on the local varieties.

Pests are a major problem in maize agronomy. Use of pesticides is inevitable in some cases, particularly in storage to control grain weevils. There are significant differences in how vulnerable the maize is to pests, which depends on characteristics of the cultivated variety. The hybrid varieties are more vulnerable to pests than local composites and application of pesticides is a pre-condition to achieve high yields. The situation is somewhat different for the local open-pollinated varieties. The husk of these varieties is harder, which generally prevents grain weevils from eating more than a few percent of the grain, even without applying pesticides. The magnitude of Stalkborer attack is also less for the local maize as compared with hybrid varieties. This is only to a minor degree related to the characteristics of the seed and the maize stalk. Local maize stalks tend also to be harder. In addition local maize tends to mature early thus escaping pest attack.

The use of industrial chemicals such as pesticides in Siaya has not been popular. Most farmers interviewed stated that they do not go for them. When maize was introduced into the Siaya ecology, some of the traditional methods of preserving grains such as sorghum, finger millets and red beans were extended to it. The Luo used to preserve their grains by dusting them using ash from burnt cattle dung or from sedge that grows in swampy places along streams. This particular ash has proved to be very effective. Selina Okeyo, who grows both

hybrid and local maize, told me that when she uses ash from burnt cattle dung or sedges from swampy places along the stream, then her local maize in the store will not suffer an attack, while over 50% of the hybrid maize will do so. She hangs planting seeds above the fireplace in the kitchen where the heat from the fireplace keeps the grains dry and hard. They are then covered by soot from the smoke. This further protects them from pest attack. The use of ash and hanging maize above the fireplace in the kitchen are ways that farmers' use to de-link them from the market. It is a strategy for lowering the cost of storing maize, taking into account what they have spent in production.

Some farmers stated that local maize is capable of some yield even when cultivated without fertilisation. Our observation is that every single household develops a local variety of maize based on how it is adapted to its specific methods of cultivation. The local seeds are both cultivated traditionally (e.g. with fallow rotation, intercropping, in ridges, scattered spacing, minimum weeding) and in rows, or through broadcasting with the application or non-application of chemical inputs and organic manure. The hybrid varieties are nitrofiles<sup>15</sup>, and set a number of specific demands on crop management. They are therefore not suited to cultivation where fallow rotation is used instead of mineral fertilisers.

Oluoch Agulu from Muhoho village planted hybrid H622 in fallow rotation as an experiment, and stated that

*'even if hybrid seeds are planted as first crop after clearing of fallow vegetation, they need an application of nitrogen fertilizer to produce a reasonable yield. The local varieties will yield higher than the hybrids when no external chemical inputs are applied'.*

The local varieties are superior to the hybrids when hybrids are cultivated under conditions of bad management, e.g. low input of plant nutrients, minimal weeding etc. This information, gathered through interviews with farmers in Siaya has been verified by adaptive research scientists from CARE-Kenya and the On-Farm Productivity Enhancement Programme (OFPEP), which has been conducting variety screening of maize in the region since 1994. They have also conducted variety trials to test the performance of hybrid compared with local composite varieties under conditions of fallow rotation only.

Their findings indicate that the exchange relation between input of plant nutrients and grain (response to fertilizer) is better for the hybrid than for the local varieties. The local seeds tend to stop responding to the increased mineral fertilizer at a lower production level than the hybrids.

Consumption end-use is another criterion that farmers use to select and develop local maize varieties. Each different local variety has its specific end-use and preference over the others. The primary end-use is flour for cooking in the

---

<sup>15</sup> The hybrids demand high levels of nitrogen to produce high yields.

form of *Ugali* (bread and porridge food staple). A bright white coloured variety is specifically cultivated for the purpose of making *ugali* and maize that has a high density so that the porridge can be as heavy as possible. A meal of such heavy porridge can sustain a whole day of hard labour in the field. The dried grains are taken to gristmills where they are pounded into maize flour or meal. Meal that has had the testa of the maize grains removed before it was milled is also common in 2kg packets in the shops. Flour from hybrid maize tends to be lighter in density, resulting in a less heavy *ugali*, thus making it less desirable.

A secondary end-use for maize is beer brewing. The maize does not have to be of any special quality and often small and deformed cobs are used. However, some farmers mentioned that local varieties finish better when used for brewing *Busaa*, particularly the multicoloured varieties. Three such varieties are cultivated for brewing *Busaa* - *otoyuoro*, *rateng* and *rakwar*. They are of high density resulting in a strong and tasty *pombe*. Those varieties can also be used for *ugali*, but it would be less desirable because of the multicoloured kernels. Hybrid maize is used commercially and often simply sold in bags, and not by weight or by quality and it is therefore less important whether the maize is fragile or penetrated by holes from insects.

Yet another local variety is mainly planted for roasting and boiling when 'green'. Local yellow maize proved to be the best choice for most of the farmers I interviewed. However, they stated that all varieties can be used for this purpose. In sandy places farmers grow only local yellow and local red. There is hardly any cross-pollination between these two varieties as they mature at different times. The lower the productivity of the soil, the more local yellow and local red will be grown. They do not need a lot of rain, are resistant to pests and perform well.

## Conclusions

This chapter has described the socio-technical networks by which the many varieties of maize spread into Luoland. The first network was through trade relations, involving different groups of people. The Portuguese first introduced maize to the coast of East Africa from where it spread inland by Arab and Waswahili (people from the coast) traders. The second network was through food and famine relief programmes organised by the colonial and postcolonial state. A third involved labour migrants working either in Uganda or on the White settler farms in the highlands of the colony who brought the seeds of new maize varieties on visits back home. The last socio-technical network was closely associated with state intervention and involved institutions such as plant breeders, extension, credit, marketing agencies and so on. They developed varieties that were high yielding and fertiliser responsive.

The chapter describes the hybrid maize regime, bred from 'progress' in the agrarian sciences, and the technology package and perceived superiority that comes with it. By implication scientific knowledge is then seen as superior to local knowledge, which becomes superfluous. The starting point has always been the technological superiority of hybrids over local varieties. However, like Greer and Thorbecke (1986), I would question whether in fact hybrid maize varieties really produce higher yields or have contributed to an increase in food security at local household level.

The mass selection regime of local maize, in contrast, hinges on a socio-technical regime of local knowledge regulated by institutions such as kinship relationships and notably, by seniority. Cross border trade and exchange among kin and neighbours characterise its proliferation practices. Preservation and (re) production is shaped and characterised by non-commoditised relationships and the character of the local economy. Local ecology performs here the role of an endogenous resource as well as a gene pool for further experimentation. The mass selection of local maize is thus an example of a niche that mirrors technological change 'from below.'

Another outcome of my analysis is the identification of hybrid maize-breeding networks that involve the generation of a commodity economy closely interlocked with institutions associated with formal markets, agricultural research, trade and marketing, and the state. State sponsored and regulated research on maize has always neglected local varieties, concentrating instead on hybrids and synthetics.

However, farmers in Siaya specifically contest the claim that hybrids are higher yielding and better for attaining food security than their local maize varieties. The details will be discussed in the next chapter. Furthermore, hybrids are generally less drought resistant than local varieties. Perhaps this is also a reason for the fluctuations in the marketed volume of maize over the past 20 or 30 years. Drought resistance is a favourable feature for maize in a country where more than 80% of the area is considered arid and semi-arid, yet even the hybrid variety with drought resistant features, namely Katumani, appears to fail once in every three years (see McGuire, 1981).

Lastly, as I have shown, the results of earlier breeding programmes, invariably undertaken outside Kenya, still feature today and most certainly have added genes to the existing gene pool of maize in the region. The hybrid maize regime, on the other hand, has never completely managed to fulfil its 'mission'. The adoption of hybrid maize in Luoland as a whole never went above 20%, and hybrid maize has always been planted alongside local maize, but never fully displacing it as in other areas of Kenya as in Nandi from the 1970s to 1990s (Hebinck, 1990) and in Trans Nzoia (Gerhart, 1976). Add to this the fact that the hybrid maize regime at present is contested and criticised by

scientists (e.g. plant breeders) themselves. The Lagrotech Seed Company that released the Maseno Double Cobber shows that within the circles of plant breeders' alternative ideas and practices emerge. This is evidence then that technological regimes, and particularly the maize breeding regimes, based on the application of scientific principles of breeding, are not homogenous at all. Indeed, a variety of maize breeding practices is followed at present in Kenya. This suggests that if these breeding efforts were to interact more regularly with the mass selection and breeding regimes in the country, then there would be hope for the future. We will return to these issues in the chapters that follow.

## **Responses to hybrid maize intervention in Luoland: redesigning and distancing**

### **Introduction**

The previous chapter showed how and through which kinds of socio-technical networks maize spread into Luoland. Whereas chapter 4 also described and analysed the processes of socio-technical regime formation in maize and how this is associated with the dynamics of the socio-technical networks involved with the proliferation of local maize varieties or land races and the hybrid varieties. This chapter specifically deals with the responses of farmers to the way the hybrid maize regime intervened in the maize landscape in Luoland and the Siaya region. The analysis necessarily focuses both on the artefact (e.g. the hybrid maize package and its prescriptions) and the institutional arrangements that surrounds the package.

This chapter also investigates contemporary patterns of maize production. One of the clear trends that has emerged over the years is that the package has barely been adopted the way research and extension prescribed and envisaged it. In other words, the package is (or was) redesigned by Luo farmers to fit their own specific conditions. Redesigning is treated here essentially as a social process and is part and parcel of the distancing processes in actor projects. These processes also mirror how technological change 'from above' (that is through planned intervention) in reality proceeds, and how in fact technological change 'from below' gets shape. The analysis of the narratives and accounts of farmers and extensionists in the region will show how and why this is taking place. A second major trend is that many farmers have stopped planting hybrid maize and have reverted to local maize varieties only. The last part of the chapter is devoted to an analysis of why hybrid maize is slowly but gradually disappearing from the Luo landscape. The analysis will also focus on problematic aspects of distancing, and the struggle to identify and get access to relevant local maize varieties. The notion of socio-technical network will guide the analysis.

### **Contemporary patterns of hybrid maize production**

In an attempt to determine the contemporary trend of hybrid maize cultivation in three of our research villages, I conducted a small survey. In each of the three villages, 40 farmers were selected at random. The table below gives a reliable indication of the types of maize that farmers were growing at the time of research.



**Table 5.1. Type of maize grown by farmers per village**

Type of Maize grown	Villages			Total	%
	Nyamninia	Muhanda	Muhoho		
No. of farmers growing hybrid maize and local maize	10	7	2	19	15.8
No. of farmers who have distanced from hybrid maize	20	22	21	63	52.5
No. of farmers who have never grown hybrid maize.	10	11	17	38	31.7
Total	40	40	40	120	100.0

Source: own survey 1998-99

As can be seen in the table, a majority of farmers have stopped planting hybrid maize, some recently, and others some time ago. A major complexity with the interpretation of the data obtained, however, is that if a farmer planted hybrid maize once in his lifetime, he or she will continue mentioning that they had always planted hybrid maize. To go beyond this I decided to select 23 farmers out of the 120 through purposive sampling to find out in more detail what had happened. This information is combined with what I observed in their fields. Two clear patterns emerge from the information obtained in this way. The first is that the initial adopters incorporated hybrid maize into their labour process in ways different from those that research and extension had recommended. They were planting hybrids in a redesigned way. The second trend is that farmers sooner or later distanced themselves in one way or another from hybrid maize production. Out of the 23 farmers selected, 22 had taken up hybrid maize but only six still grew it in combination with local maize. Sixteen distanced themselves completely from hybrids and had gone back to growing local maize only, and one farmer had never grown hybrid maize at all. Generally, those who had never grown hybrid maize were the young farmers, and women farmers who had lived in town. Detailed discussions with these 23 farmers gave a whole series of reasons as to why this is the case. Let us turn first to the redesigning process. Later I will focus on distancing from hybrids, and why and how (with what kinds of sources of information) distancing is taking place.

### The redesigning of the hybrid maize technology package

I analyse here the why's and how's of redesigning with reference to the recommendations or prescriptions that come with hybrid maize package (summarised in chapter 4).

The first prescription is timely land preparation. To achieve this some degree of mechanisation was recommended, using ox-drawn plough or tractor. None of the farmers interviewed had their land ploughed by a tractor during the time of the research. Some stated they would like to hire one but tractors are nowadays very few. Out of the eight tractors brought into the district, only two were operational at the time of fieldwork and these were not well maintained. Ox-plough combinations are available, though their number has also decreased significantly. In Muhoho village, there is only one person with an ox-plough. In Muhanda there are three and in Nyamninia and Luero none. The majority of farmers prepare their land using a hoe, stating that hiring an ox-plough was too costly. The reduced number of people operating with the ox-plough has raised the cost of hiring one. Yiengo Rateng (see Case 4, Chapter 3) stated that although he agrees that the price is high, he would be willing to hire one if the quality of ox ploughing was good. However, since there is hardly any competition, men with ox-ploughs rush from one plot to the other to earn as much money as they can, which lowers the quality of tillage. Therefore Yiengo prefers to hire labour and to prepare his land with a hoe. Abednego Ochieng (Case 1, Chapter 3) relied heavily on family labour until his church gave him an ox-plough and oxen. Now he can afford to prepare his land on time. Another factor is the reduction in the number of oxen due to reduced land sizes and grazing grounds. Abednego adds that

*'Cattle rustling have also reduced the number of oxen in the three villages. Most people point fingers at Ochung Ambazi who owns several businesses in this region. I think that the people stealing cattle from us are on his pay roll. Though he himself does not go out to steal, he networks with cattle thieves and gives them guides from the villages. In the end he profits. He then ferries these cattle in his lorry at night to Busia border where the cattle find their way to Uganda through traders'*

Asked how he knew of this, Abednego told me:

*'Through one of his agents, who one day had bad luck and was caught red handed by cattle owners untying cattle from the kraal. After thorough beatings, he confessed to us that Ochung sent him. They were both arrested and arraigned in court. However, Ochung being a man of means, bailed himself out of the case by bribing the magistrate. This we believe.'*

Lack of timely land preparation means delayed planting. Cattle rustling have been a big blow to farmers in the region, as most people with ox-ploughs do not have enough bulls to use them. The result has been a reduced acreage for planting cereal crops as people have turned more to hand hoeing.

The second prescription is timely planting at the onset of rains. That is between 15 February and 15 March in the long rainy season, and around the 15th of August in the short rainy season. Many farmers experience problems in planting early and therefore redesign the package. Preparing the land with the hoe before a growing season takes a lot of time. Therefore, if households' lack labour and do not have the financial means to hire it, the result is often unfinished land preparation at the onset of the rains, which means the planting gets done late. Amongst others, Susana Serwa (see Genealogies, Case 5, Chapter 3) and Gladys Awiti, a farmer from Muhanda village had this problem. Walking through the rural areas of Muhanda, Muhoho and Nymaninia villages, when the rains have just begun, one sees many plots not yet prepared for planting for lack of labour. The problems are more serious before the short rainy season. The harvest of the long rain season normally takes place at the beginning of August. This means that households that want to grow maize again on the same plot, which they often do, because of lack of land, have only a week for land preparation.

Another factor that delays timely planting of maize is the principle mentioned earlier of *golo kodhi* (first sowing), which means that certain agricultural activities, such as sowing, must be carried out in order of seniority. Thus, if for instance the head of the homestead, the *jaduong dala*, cannot sow at the onset of rains, e.g. because his land is not yet prepared, the other household members also have to postpone their sowing. A good example was that of Rose Muga, the senior wife to Erasto Muga (Case 5, Chapter 3), who could not sow on time because she had to attend her father's funeral. This meant that the three junior co-wives had to wait until she came back.

Delayed planting interferes with the third prescription - that the right hybrid variety of maize should be selected and planted at the right time. As stated, the six series (H626, H625, H614 and H622) are considered to be most suited for the research area, which lies in the northern highlands of Siaya and receives sufficient rainfall to give a high yield. However, late planting means that these hybrids, which take at least five months to mature, may not mature in time. For that reason, farmers who have to plant late in the long rainy season, often plant the early maturing five series hybrid varieties (H511 or H512) which are also drought resistant. This is exactly what Gladys Akinyi did when she had to postpone sowing in the long rain season of 1996. Hybrid 511 and 512 was prescribed for southern Siaya with low rainfall.

The fact that H511 and H512 are nowadays prescribed by the government for northern Siaya is partly the result of farmers' redesigning. The five series were developed especially for areas that receive less rainfall and were therefore considered to be especially suited for the South of Siaya, which is much dryer

than the North. However, according to George, an extension officer in Yala Division, farmers from northern Siaya who saw H511 and H512 in the fields of relatives in the South of Siaya, in the early seventies, tried them on their own farms in the short rainy seasons when they normally receive less rainfall. This rainfall starts in August and goes up to early December. Sometimes it can subside in October and is generally unreliable. The earlier maturing, more drought resistant five series fitted in well thus with the short rainy season. At that time the government had no policy on the short rainy season in Siaya. It was expected that the six series in the long rain season would yield enough for farmers to live on until the following years harvest. The fact that farmers in northern Siaya started growing H511 and H512 induced the government to integrate those varieties in their recommendations for the research area.

Furthermore, not all farmers plant the recommended hybrids. They choose different ones for different reasons. H622 is the most popular. Susana Serwa stated that she first tried H632 but that the cob husks opened when the maize was still growing and that the cob started rotting. Then she tried H622 and this variety did well for her. Also Abednego Ochieng and his brother Oketch Bundmawi (Case 1, Chapter 3) went for H622. Selina Okeyo, however, considers H622 inappropriate since it grows too tall and then lodges. She prefers H625. Apparently, many farmers disagreed with her because the stockist in Yala town stopped selling H625 since the farmers no longer wanted to buy it. According to one farm-input stockist in Yala, farmers complained it could not stand drought. Joseph Ogwanjo a dairy farmer from Nyamninia prefers H626. He first tried H632 but he experienced the same problems as Susana Serwa with this variety, opening husks and cob rot, and he found H626 suited him well. Ochieng Monye (Case 6, Chapter 3) grows H512 in the short rainy season and Pannar 5195 in the long rain season. Pannar 5195 is a variety developed and recently released by a new, private seed company. However, Ochieng Monye is a contact farmer for almost all the interveners in that region and hence he gets the seeds and fertilisers free. In the 1998 long rainy season he was even experimenting with wheat. Wheat is not meant for Siaya given its warm climate and an inadequate rainfall for its growth.

Other farmers redesigned the hybrid maize package by using the grains harvested from hybrid maize as seed for the next season. Joseph Ogwanjo stated that when he lacks money to buy seed, he sometimes plants the H626 seed selected from the previous harvest. However, he mentions that the yield is lower than the original seeds even if he applies inputs. Furthermore, farmers never planted hybrid maize only. Always a mix of local and hybrid maize were planted. Farmers did this in order to avert risks that could emerge due to sudden weather changes that affects hybrids adversely than locals. Furthermore local maize matures early thus helping farmers to evade famine.

Most important is that, even if a farmer plans to plant hybrid and he has resources to do so, he always started with local maize in his *mondo* to honour *golo kodhi* ceremony.

The fourth prescription was a spacing of 75cm by 30cm. This prescription was redesigned in many different ways. Some farmers used narrower spacing, for example Esther Olawo, headmistress in a nearby primary school and a farmer in Muhanda village, sowed her maize at 45cm by 15cm. She argued that since she only has small plots, one of 0.5 acres and another of 0.25 acres, she has to use a narrow spacing to produce enough maize for her household. A number of farmers sowed at 60cm by 30cm, like Oluoch Agulu (Case 3, Chapter 3) and John Oworo a farmer from Muhoho village. Abednego Ochieng sowed his hybrid maize at 75 cm by 25 cm. He has experimented with different spacing (60cm by 60cm and 90cm by 30cm) but 75cm by 25cm gave him the best results. Joseph Ogwanjo, who normally uses 75cm by 30cm, experimented in the short rain season of 1998 by sowing maize and beans in the same seed hole at 60cm by 30cm. He reasoned that this enabled the maize and beans to benefit both from the DAP fertilizer that was applied. There are also farmers who use a wider spacing than recommended. Oketch Bundmawi, for example, sowed his hybrid maize at 90cm by 60cm, since hybrid maize sown at 75cm by 30cm in his opinion remained very thin, which increased the risk of lodging. However his brother Lomo said that he is boasting, because he has extra income from his job as an Assistant Chief. Before getting his job he was farming normally. Many other farmers sowed at 90cm by 30cm, like Selina Okeyo and Susana Serwa. A reason for this wider spacing brought forward by farmers who use it is the intercropping of maize and beans.

This already implies that growing maize as monoculture is also adapted. Of the farmers interviewed, all but one stated that they intercropped maize with beans. They gave many different reasons for this. Oketch Bundmawi and his brother Lomo mentioned land shortage as a reason. Secondly, Abednego their elder brother said that since their families, as a result of monetary problems and the reduced numbers of cattle and poultry on their farms, lack access to meat and eggs for consumption, beans are their main source of protein. Third, beans reduce the negative effects of striga, according to Abednego, Esther Olawo and Ochieng Monye. Striga is a parasitic weed that feeds directly from the roots of maize thus offering stiff competition for nutrients with the maize plant. However, striga cannot connect with the roots of the bean plant and furthermore the presence of bean roots makes it more difficult for striga to connect with the roots of the maize plant. Fourth, Selina Okeyo and Esther Olawo told us that beans fertilise the soil since they fix nitrogen. And fifth, the combination of maize and beans covers the ground completely, which reduces wind and water erosion, according to Oketch and his brother Lomo. The only

farmer not to intercrop beans with hybrid maize is Yiengo Rateng (Case 4, Chapter 3). He believes that intercropping beans will not give him a maximum return on his investments, since the big leaves of hybrid maize plants take away so much light that the beans cannot grow optimally. Therefore Yiengo grows maize and beans both in a pure stand. Being a well-to-do farmer, Yiengo does not experience the problems of land shortage nor insufficient access to animal protein. He can afford to feed his wives and his several children from his income both from the farm and businesses. Further, he takes care of his deceased brother's wives. He does not want them to remarry because of HIV/AIDS. Instead he prefers them to stay the way they are so that they take care of their children. He does not believe in the Luo custom of remarriage after the husband's death.

The fifth prescription, sowing in rows with holes using a planting line was also not widely adopted. Only a few farmers like Selina Okeyo, Joseph Ogwanjo, Abednego Ochieng took up line planting in totality. The majority oscillated between line and staggered method of planting. Those who favoured line planting associated it with higher yield just because extension staff had recommended it, or it made weeding and harvesting easy. Some farmers also felt that lines allowed for more crops or prevented maize from falling in heavy wind. Most farmers who grew local maize used the line planting recommended for hybrid maize. Rose Muga broadcast her maize because she does not grow hybrid maize. Susana Serwa also broadcast her hybrid maize seed in 1998 long rainy season as she did not have sufficient labour to prepare the land and practice row planting. She broadcast the hybrid maize seed on uncultivated land and as covered the seeds as she cultivated. In the 1998 short rains Abednego did the same. The reason for not following the recommendation for hybrid maize technology is that it is labour demanding.

The sixth prescription of the hybrid maize technology package is that 50 kg of DAP fertilizer should be applied per acre when sowing. That means one teaspoon of fertiliser per planting hole. This prescription was also redesigned. Selina Okeyo uses only 25 kg of DAP fertilizer per acre. She mixes DAP with a hand full of farmyard manure (a mixture of well rotten cattle dung, urine and crop residues) per hole. Susana Serwa, and Joseph Ogwanjo grew hybrid maize with the application of farmyard manure only. No DAP fertilizer was used. Both mentioned that they do not use DAP fertilizer since they cannot afford it and they have sufficient farm yard manure from their zero-grazing units. The price of a bag of 50 kg DAP fluctuates between KShs 1,200 and 1,500 KShs<sup>1</sup>. For comparison, a primary school teacher in Kenya earns about KShs 5,500 a month. James Otieno used DAP once in his zero type local maize and it

---

<sup>1</sup> Between July 1997 and December 1998 the Dutch guilder was equivalent to KShs 33.00.

did not improve much. He stated that although he can afford to purchase DAP, he does not use it since he has eight local zebu cows that produce a lot of farmyard manure and thus DAP fertiliser is a waste of money. James Otieno spreads the farmyard manure over his whole plot before land preparation rather than applying it at sowing.

Four weeks after sowing a top-dressing of CAN fertiliser should be used. The majority of farmers interviewed do not top dress their maize with CAN. It is too expensive. Those who use it, prefer using it in high value crops like kale, cabbage, and tomatoes. Abednego and his younger brother Oduor Lomo use it on their kale and tomato plot. Kale brings in a good income, which they plough into other enterprises. Selina Okeyo uses it on her tomato plot but at half rate. She prefers manure from sheep dung believing it to be more powerful than cattle dung. Some farmers thought their maize did not need CAN. All 22 farmers who had grown hybrid had used CAN at least once on maize. However, none applied it on maize during the research period.

The seventh prescription is that the hybrid maize plot should be weeded at least three times. However, most farmers interviewed weeded only once. Susana Serwa stated that when her husband was still alive and her four sons were still living at home, they used to weed twice. Other farmers also stated they lacked the labour to weed thrice. Abednego Ochieng, who was considered a pioneer farmer, could weed thrice during the early days when KARI research officials provided money for the labour. And his plots were test plots and it was important the third weeding was done. Since then he has never managed to weed even twice for lack of labour. Yiengo Rateng weeded twice during the days he grew hybrid maize. He still weeds twice as he believes that is the best way to deal with striga in a plot. James Otieno weeds his zero type of maize twice because he has the money and can pay the Abaluhya's who come to look for casual work in the village. He does not use members of his village on his farm.

The eighth and ninth prescriptions were the use of pesticides, such as DDT when the maize is still growing, and actellic applied to the harvested grains for protection during storage. Very few farmers interviewed stated that they used DDT. This was for lack of money or because they did not consider the chemicals to be very necessary. Patrick Odongo, an experienced old farmer, stated that DDT interfered too much with the growth of maize, and also mentioned that its use had been outlawed since it was unsafe. None used such a chemical during the research period. Abednego Ochieng, his younger brother Lomo and Selina Okeyo who were practising horticultural farming, only bought chemicals such as Ridomil, Ambush and Dithane M-45, to use on high value crops such as tomatoes and kale. The majority were not using actellic before storing the harvested maize. Some applied nothing, others

redesigned the package by applying ash from burnt cattle dung and sedges. The farmers that used this technique, such as Selina Okeyo, Susana Serwa and Mrs Agneta Otieno, wife to James Otieno, stated that they learned it from their parents and that the technique had with the Luo for a long time. It was an old practice that had proved its worth and they therefore could see no reason to buy actellic. Agneta also states that actellic left a bad smell on the grains and that *Ugali* made from such grains upsets the stomach. Other farmers, like Margaret Odera (Case 7, Chapter 3), particularly those who have developed their own local maize seed, preserve it for the next season by hanging the maize cobs above the fire place. It is through this technique that James Otieno secured the seeds of his late mother. All these farmers stated that they learnt this technique from their parents.

### **Distancing**

I now wish to discuss reasons why farmers who had earlier interlocked their farming projects with the government in the field of hybrid maize production are now distancing themselves from it. As mentioned earlier, I use the term distancing to capture the process by which farmers de-link their production from agricultural innovations and the institutions that have an interest in their adoption. It is a moving away from the early modernisation projects introduced into Siaya district such as hybrid maize, coffee, cotton and sugarcane.

In the previous section I indicated that there were six farmers still growing hybrid varieties of maize alongside local maize. However, these same farmers gave me reasons for why they are distancing themselves from hybrid maize, a process they at present refer to as temporary or partial distancing. Partial distancing means that a farmer has shifted to the cultivation of both hybrid and local varieties, while total distancing is where a farmer who once grew hybrid maize, now concentrates more or less entirely on growing local maize.

One of the survey findings is that most farmers in Siaya are moving away from hybrid maize. Detailed discussions with twenty-two farmers who once grew hybrid maize or still partially grow it rendered a whole series of reasons as to why this is the case. The arguments can be grouped into three broad aspects: market and institutional failures, agronomic values, and the cultural repertoire of the Luo.

#### *Market/institutional failures*

Issues related to market failures do not disqualify hybrids from an agronomic and/or cultural point of view, but have more to do with the quality of relationships between maize cultivation and institutions such as the market. For some this is a reason to redesign such relationships, which in fact amounts



to unpacking the set of prescriptions surrounding hybrid maize, analysed in the previous section. For some people this is a reason to distance from the hybrids and the markets. One of the arguments for distancing oneself is the high costs of inputs such as the maize seed itself, and the fertiliser it needs. This counters the arguments of the six farmers still growing hybrids alongside local maize that hybrid maize is an economical crop to grow in Luoland. In addition, the lack of capital to purchase the necessary inputs is an argument and credit facilities were specifically mentioned in this context. Also the unavailability of inputs and the perceived deterioration in their quality, especially seed, but also fertilisers were also mentioned as a reason for ceasing to grow hybrid maize<sup>2</sup>. The question of credit availability is, therefore, important to the discussion of whether the hybrid maize programme can be labelled as a success.

An important feature of hybrid maize technology is that it makes the farmer increasingly dependent on the market for inputs. Unlike traditional cultivation methods, where farmers use last year's seed for cultivation and either uses farm yard manure or no fertiliser at all, hybrid maize technology makes him dependent on the market for the supply of new seeds, chemicals, fertilisers, pesticides, herbicides and hired labour for harvesting, sowing and other operations. The new inputs are expensive and require considerable financial resources in relations to the yearly income of an average farmer. This was exacerbated when as early as 1980 the Kenya government withdrew subsidies for farm inputs.

Due to market liberalisation, the government no longer regulates the costs of farm inputs. Traders fix their prices according to demand. Around the time of planting, the cost of fertiliser rises. The price of a 50 kg bag of DAP fertiliser can rise from 1,500 to 2,000 KShs. It might also not even be available. The price of a 50-kg bag of CAN fertilizer is about 1,200 KShs, a 2-kg packet of hybrid maize seeds is 145 KShs. This means that if one wants to plant at the recommended rate of 10 kg per acre, one has to spend 725 KShs on seeds alone. This is beyond the reach of most farmers in the region. The latest Kenya Government statistics on poverty indicate that over 56% of Kenyans cannot afford sufficient food, safe water, health care, shelter and education. It also shows that the majority of Kenyan adults rely on about 30 KShs for their daily needs (E.A.S. news 9/2/01). Selina Okeyo a farmer from Nyamninia village who has partially shown distancing from hybrid maize claims there are many reasons

---

<sup>2</sup> In an on-farm research report, CARE-Kenya and KEFRI support the notion that farmers lack confidence in inorganic fertilisers (CARE/KEFRI 1996: 8).

*'why farmers around here are leaving the growing of hybrid maize. First is the cost of inputs and transport for ferrying the inputs to the farm. I can imagine that this is a big problem for poor farmers. I use 25 Kg of DAP per acre (half the normal rate) and supplement with boma (farm yard) manure. If I top dress, I use only 10kg of nitrogen fertiliser per acre instead of the recommended 50kg and I only do this after seeing the growth vigour of the maize and I am certain they will do well to earn me some profit. The majority of farmers around here are not able to buy fertiliser neither do they have cattle to get farmyard manure. Transportation of these inputs to the farm is so costly that it is an impediment to adoption of hybrid maize package. I use public transport to Luanda market in Vihiga district and there I purchase fertiliser and other inputs and pay for their transportation back to the farm. When my husband is back home from Rongai farm I use his pick-up van. Poor farmers cannot afford to do this. Even me, I always think that I use a lot of my money on these inputs'.*

Sometimes the inputs are not available in time. Their late arrival has been cited by most farmers as one of the reasons for their withdrawal from hybrid maize, even when they can afford to pay for them. Sometimes private traders hoard and create artificial scarcity during the period of heavy demand in order to get high prices. Priority of input supplies is first given to large farmers in the high potential areas of Rift valley, Western and Central Provinces. Fertiliser is often sold on the 'black market' at prices higher than government controlled prices. According to Abednego Ochieng, such 'black market' situations occur even in cases where the overall supply is sound but the timing of its arrival is not synchronised with the timing of its use. From a survey I carried out in markets in Siaya in early February 1999, just before the start of the long rainy season, none had a stockist with the DAP fertiliser required during the planting period. Even in Kisumu, the capital of Nyanza Province, such inputs were scarce. Stockists in Siaya district normally stock hybrid maize seed and fertiliser just before the growing season starts, but in small amounts to make sure that they can sell everything. Thus, contrary to the situation in the early seventies, nowadays inputs often arrive too late and what arrives is too little. When inputs are not available in Siaya district only well-to-do farmers like Yiengo Rateng, Selina Okeyo and Patrick Odongo can afford to travel the 40-km to Kisumu to buy the farm inputs they need. Transporting them back to their farms is an extra cost. Thus, when inputs are not available in the nearby markets at the beginning of the planting season, farmers who had planned to grow hybrid maize will not take the risk of waiting, and will go ahead and plant local maize.

The second reason, and closely related to the previous one, is the lack of or malfunctioning of credit facilities in the area. Two farmers gave this as a reason for distancing, although many agreed that such facilities were absent or malfunctioned. The Agricultural Finance Corporation (AFC) was established especially with the aim of enabling farmers to acquire loans to engage in

commercial farming. Very few farmers actually managed to get loans from AFC. Those who did were later harassed when it came to loan recovery and this scared most farmers from soliciting such loans. Most farmers disliked the procedural delays, the bureaucratic formalities (e.g. the processing of cheques) and also the financial commitment the loans from AFC involve, e.g. a 10% kick back of the loan share in the AFC and paying 10% interest. As long as the use of high-yielding varieties largely remains confined to politically correct and well endowed telephone farmers, the issue of credit, both the amount and the patterns of distribution, assumes little importance.

Even Oketch Bundmawi who is now a salaried assistant chief in his area laments that getting a loan is very difficult. He complains that banks only pay attention to the acreage a farmer cultivates.

*'For one to get a loan you must have at least 2 ha. They do not consider the farmers experience, his management capability and the crops he is growing on his land. These should also be made criteria for deciding who gets a loan. Banks should send their officials to visit farmers and then do some assessment of the grounds for deciding if they can give a loan or not rather than just looking at what is written on the title deed in terms of land acreage. Individuals have difficulties in getting title deeds because of land ownership in the Luo context; land ownership is something gradual. The high interest of loans by AFC and commercial banks plus 10% kick back demanded by their officials are economic constraints. Sometimes the interest rate is 16%. The financial bodies are overburdening farmers. Projects which were started by the government to assist in giving farmers loans are not working well because of the agents in between.'*

Poverty and the inability to borrow to finance discrete increases in expenditure can be formidable barriers to the adoption of even the simplest of productive innovations, and in spite of the high 'divisibility' of hybrid maize itself, the recommended package of seed, fertiliser, and insecticides can represent a substantial outlay for a farmer with a small net income. Add to this the bad experiences with taking loans from financial institutions and it little wonder that farmers in the region are distancing themselves from hybrid maize. Oketch says that giving a title deed to secure a loan could lead to your land being sold. Quoting the bible (the book of genesis) he says that<sup>3</sup>,

*'Land was God given and is not something to play around with. Loans are attached to title deeds. If you fail to pay back the loan, your land is auctioned. When you sell your land you will get cursed. I have noticed that only the people who gather the fruits from their own land become successful. The system of attaching loans to the land should be changed. The loan*

---

<sup>3</sup> Oketch stated that in the old days land was considered to be a sacred thing. 'God gave it to our forefathers. God told them, get this land, till it and get your food from it for you and generations to come. If you sell your land you will be cursed. When I grow bananas on my land and sell them I get money. If I invest this money in another business, this business will flourish. But if you sell your land, this money will bring you no success'.

*should be attached to the things on the land (the crops). The idea of attaching a loan to the land is what has made me not to apply for a loan. I do not have a land title deed yet'.*

However, Oketch's younger brother, Oduor Lomo, puts it differently. According to Oduor, farmers in Siaya do not like going for loans because the government agents harass them. When I asked him if it was true, he said:

*'These things happen and are a common knowledge to members of the Luo community. For instance after the National Poultry Development Project failed the donors wrote off the loans advanced to farmers countrywide. But officials of AFC and commercial banks kept on harassing people from Nyanza to repay their loans while people in areas where the government receives support were protected. Luos have very little support. When they get loans, they are harassed. My brother Abednego is still paying a loan that should have been written off a long time ago. But since he comes from an area where the government receives little support, he is still being harassed. Furthermore the interest he is paying on the loan is higher than when he started. And there are many more farmers complaining like that. From these examples Luos have learned to keep away from these financial institutions.'*

Oduor believes that self-determination is being impeded in Luoland due to their political affiliation. Financial institutions harass them to ensure they do not ask for loans. For those who succeeded in getting them, they are never at peace from that loan. Of the farming households selected only four ever obtained an AFC loan, namely those of Joseph Ogwanjo, Yiengo Rateng, John Oworo and Abednego Ochieng. One reason for this small number is that many farmers do not hold the title deeds for their land, needed as security for a loan. A more important reason however seems to be the political patronage system in Kenya. The Luo have always been in the opposition since 1966, thus leading the government to withhold grants for development in the area.

By the year 1978, the Ogonji family was already growing hybrid maize as their favourite cereal crop. Many farmers were then interested in growing hybrid maize even when they were also growing local maize varieties. People were not under the pressures brought on in 1979 when fertiliser subsidies were removed and 1980 when structural adjustment programmes started to take shape. And in 1982, the production of hybrid maize dropped even more heavily due to severe drought that led to food shortages. The price of maize shot up. It marked the turning point for many farmers. Famine relief had to come from America in the form of yellow maize.

Add to this prolonged drought and the failure of the short rainy season and farmers started to think otherwise about hybrid maize. Abednego Ochieng told me that,

*Planting maize as a commercial crop is no longer very economical. You use a lot of inputs and the output is not very encouraging. The farming practised here has a lot of risks. Crops and animals are not insured. I do not like taking risks anymore. I am still servicing a loan I was given by the AFC. I do not have sufficient labour to manage hybrid maize. Thus I have*

*decided to plant local maize due to lack of capital. 'A lion can feed on grass when it reaches the worst'. We are now opting for sorghum. Look at the lower section of my farm, I have decided to plant sweet potatoes there and in the upper section I have decided to plant cassava as the soil there is more eroded and as such is quite infertile. Besides this, I nowadays plant bananas which give me some income during difficult times. Fertiliser shortages are nowadays rampant. The government would rather re-export the fertiliser that has been brought by the donor agencies and make money instead of thinking about the farmers.'*

There has been general public outcry about the deterioration in the quality of farm inputs (E.A.S news paper 29, 2001). With the growth in private trade in seeds, there has been a steady deterioration in the quality of new seeds. The seed farmers do not always take proper care to produce seeds of the right quality, or to sort out good seeds from bad. Adulteration of seeds is widespread, which regularly accounts for the uneven record of these seeds over time and space. The incentive for adulteration is high, given the considerable difference in price between old and new seed varieties. Mixing of high-yielding varieties with local varieties, in addition to reducing yield, creates difficulties in harvesting as crops ripen at different times and grow to different lengths. Farmers in the villages researched mentioned 'low germination', 'poor quality' and 'mixing of varieties' as reasons for non-participation. With the decline in the quality of seeds marketed as high yielding varieties, the farmers' faith in them is being eroded.

Secondly, farmers believe that the quality of fertilizer has deteriorated dramatically. They stated that when they started growing hybrid maize in the 1960s and 1970s the quality of fertilizer was still good. The current fertiliser has a negative impact on the soil and once one starts to use it, you have to continue using it. A consequence of the domination of the fertiliser market by private traders at a time of scarcity is the appearance of various corrupt practices. Adulteration is a common feature of the private trade and a major cause of discontinuation of fertiliser use by many farmers after one or two crops.

More recently, there has been market liberalisation of hybrid maize seed and companies have mushroomed that import hybrid maize seed from other countries and sell at a cheap price to farmers. These companies offer stiff competition for the Kenya Seed Company. Some of the hybrid maize seed now marketed by various companies - Pioneer, Cargil and Pannar (PAN5195) - are being tried out on small plots by Monye. When Monye got Pannar (PAN5195) seed, he grew it once, and has since been trying to select the big cobs to form the seed for the next season. This has not worked well, as every season the yield tends to decrease.

Patrick Odongo a farmer and a former headmaster of Muhanda primary school believes that the deterioration in quality of farm inputs began in the late 1980's. Patrick Odongo stated that

*'In 1988 we experienced problems with inferior seed for the first time. The germination of the seed was poor and furthermore the plants indicated that the seed was not real hybrid seed. In 1988 we harvested only 15 bags of maize per acre while in previous years the yield was 25 bags, with exactly the same management. We grew hybrid maize for two more years but the results got even worse. In 1990 we decided to stop planting hybrid maize.'*

Most farmers, according to Odongo, suspected that fake seeds were supplied, i.e. local maize seed instead of hybrid seed. It is not clear who was responsible for this. Maybe it was those who at a certain point were involved in hybrid maize development and distribution like KSC, or the stockists, or both. In the past stockists got hybrid seed in 25 kg or 10 kg bags only. If a farmer needed hybrid seed for just half an acre, a few kilograms were taken out of such a bag. This gave stockists the opportunity to top the bag up again with seeds of unknown origin. All they needed to do was dust local maize seed with a coloured pesticide normally applied on hybrid maize seeds and farmers could not tell the difference. The introduction of sealed two-kilogram seed packages should have solved this problem. However, most farmers believe that corrupt traders are making the KSC packets and selling them to particular stockists. In 1993, many KSC seed packages contained broken seeds, some of which were even infected by weevils. Farmers, like Abednego Ochieng, believe that KSC distributors export the best hybrid maize seed to countries like Uganda and South Africa to create a market there and that the Kenyan farmers are supplied with the left over inferior seeds.

Such farmers also believe that the quality of fertiliser has deteriorated markedly. Odongo stated that since he started using fertiliser in the 1940s it has been good until recently, but the quality of today's fertiliser does not improve the yield of the maize grown as it did when hybrid maize was introduced. On-farm research by CARE and KEFRI confirm this view (CARE/KEFRI 1996: 8). Abednego told us that when he had dairy cattle, he would mix farmyard with poultry manure and applied this at the rate of one handful per hole of two hybrid maize seeds, and complemented this with DAP fertiliser at the rate of 12 grams per hole; maize produces extremely high yield.

*'We lack proper inputs, this is what is producing low productivity. The kind of fertiliser we receive nowadays is not good and that is why some farmers say it spoils the soil. I think there is something wrong with the fertiliser we receive nowadays. Since we cannot afford to buy a whole bag of fertiliser, traders divide fertiliser in this bag into small packages that are affordable to us. Maybe during this time, they add other things not known to us.'*

Another aspect of institutional failure concerns the lack of farm machinery or mechanisation that I have already mentioned. This poses a serious constrain

on labour as farmers rely on manual labour and the hoe to cultivate their land. Tractors are few and expensive and ox-drawn ploughs are also getting fewer and fewer due to reduced cattle numbers. Since the introduction of high yielding varieties of maize, the use of tractors has always been concentrated in high potential areas outside Siaya district where large-scale farming and farmers with mobile phones are located.

The local frame of reference obviously is that in previous conjunctures, i.e. during the hey days of the hybridisation campaign - the credit market, like the markets for seeds, fertiliser, draught power, and so on were operational. In addition people were willing to invest money earned through other sources (migration, remittances, odd jobs and so on) in the cultivation of hybrids. However, a general distrust of the market is now clearly expressed. Listen to the woman farmer Selina for example:

*'One other thing I forgot to tell you concerns the quality of hybrid maize seeds. Since market liberalisation, most of our good quality maize seeds are going to markets in countries like Uganda, Tanzania and Rwanda. The government earns more money when Kenya Seed Company sell the seeds there. Big farmers in the Rift Valley Province take up the remaining good seeds. So what sometime reaches us is doubtful. Anybody can sell anything to you as hybrid maize seeds as long as it is dusted with the green chemical they use for real hybrid maize'.*

The economic crisis that has faced Kenya since the late 1970's (Maxon and Ndege 1995: 151-152), is another element that contributed to the agricultural crisis in Siaya, and also had a strong impact upon the distancing that has occurred from the hybrid maize technology package. This economic crisis and the subsequent Structural Adjustment measures led to increased unemployment (*ibid*: 157-158), with major consequences for the 'labour reserve' in Siaya, since the flow of remittances from relatives in towns like Nairobi, Mombasa and Kisumu declined significantly. Furthermore, inflation, another effect of the economic crisis, resulted in a fall in real wages, which further decreased the flow of remittances, and in price increases of products like hybrid maize seed and fertiliser. Thus from the late seventies and early eighties when the effects of the economic crisis became perceptible, lower incomes and higher input prices have decreased the farming household's access to hybrid maize cultivation.

#### *Agronomic characteristics of hybrid maize*

The second group of arguments hinges around agronomic issues, such as the characteristics of hybrid as compared with local varieties. These cannot be disconnected, however, from culturally related issues such as taste. Local maize out yields hybrids, especially when only farmyard manure is applied and is mentioned as a powerful argument to stop planting hybrids and return

to local varieties. In close association with this, as already mentioned, farmers say hybrid maize lodges more; the cobs open and give rot and bird damage, and it is less resistant to weeds, pests, diseases and sudden changes in weather conditions, and that hybrid maize takes too long to mature, does not store very well and is easily attacked by weevils. Local maize is preferred exactly for the opposite qualities.

Other agronomic arguments hinge around soil fertility and the application of fertilisers. Soil fertility has become a major issue in Luoland and the proposed way to reproduce soil fertility, through the application of fertiliser, is strongly contested by the farmers who claim that 'fertilisers spoil the soil', and that 'the soil becomes addicted to fertiliser', and that 'fertilisers stimulate the growth of striga'.

Let us pick these issues one by one and look at them closely. Without the application of artificial fertiliser, hybrid maize is out yielded by local varieties. This implies that without inorganic treatment, engaging in hybrid maize becomes unrealistic and thus distancing becomes a logical step. This idea is supported by almost all farmers who advanced it as a reason for their distancing from hybrid maize. It further confirms one of the features of hybrid maize and 'apparently for what it was bred' that it is fertiliser responsive.

Esther Olawo, a farmer from Muhanda village told us that, in her opinion, fertiliser spoils the soil and stimulates the growth of striga weed, and for that reason she distanced from fertiliser and subsequently also from hybrid maize since according to her local maize out yields hybrid maize when no inorganic fertilizer is applied. However, when interviewed together with her friends Abigail Ochuoga from Nyamninia village and Susana Serwa, they claimed that not all farmers saw local maize as out yielding hybrid varieties without inorganic fertiliser, but this was because of improper selection of local seeds. Esther maintains that in either case local maize and hybrid maize management requires a lot of labour to yield highly. She believes that the low yield potential realised by some farmers who grow local maize is because they assume that local maize do not require proper care.

Apart from the fact that hybrid maize yields are lower than those of local maize when no fertilizer is applied, other growth characteristics of hybrid maize were also advanced as reasons for distancing by selected farmers. One reason is that hybrid maize is late maturing, taking between 150 days for five series and 180 for six series as compared with 85 days to 120 days for local maize. By February, in Siaya, the granaries of most farmers are empty. This means they need a crop that matures early to help them stave off hunger from March to July, and the long maturing period for hybrid maize makes it unsuitable for this purpose. Earlier, in chapter three, I indicated that farmers in the district have difficulties in planting on time at the onset of the rains, due to



labour problems. Therefore if farmers complete land preparation in April or May in the long rains, or in September or October in the short rains, hybrid maize takes too long to grow to match the rainfall regime or peaks, even for the five series. So farmers opt instead for a local maize variety, which they broadcast and cover with soil as they prepare the land. As Ochieng Monye confirmed,

*'The advantage of local maize is that it is early maturing. Our stores get empty by February and we have to wait a long time for maize to be ready. In between we really struggle to find enough to eat. The fact is local maize is as good as hybrid maize. It does not demand a lot of input and is not as labour intensive as hybrid. Locals are hardy and can resist pest attack in the store. They can even be stored up to three years. Normally when I see local maize somewhere, I bring it here.'*

Ochieng Monye grows sorghum and both local maize and several cultivars of hybrid maize depending on the season. The hybrid maize is grown on trial plots where CARE-Kenya or the Ministry of Agriculture carries out demonstrations. At a distance plot he grows local maize. In some of his trial plots with CARE-Kenya he grows also local maize that is selected by its extension staff. CARE-Kenya is involved in varietal screening of maize to ascertain which one is suitable for that particular area. He gave me the reply above to a question as to why he had given a large acreage to local maize. He also mentioned other reasons such as the husks of hybrid maize cobs opening before the maize is fully mature in the field, exposing it to pest attack and rot in poor weather conditions, and thus yielding poor quality maize. The difficulty in acquiring seed and its need for expensive inputs

In defence of local seed Ochieng Monye mentioned several of the points mentioned by Selina below saying Uganda white produced aggressive root systems and a strong stalk capable of producing prop roots above the ground. He believes that low maize yield in the village were not because of seed variety but due to poor husbandry. If local maize seeds were properly selected and given good treatment in terms of adding manure and proper weeding then they were as good as hybrid variety of maize.

Another reason given for distancing from hybrid maize is that it lodges more in strong winds because its stem is not as strong. It grows very tall and produces heavy cobs. Local maize produces prop roots to the third node above the ground and this enables it to resist lodging. Lodging occurs particularly from late April to early June, when Siaya district is often afflicted by heavy storms. Also, hybrid maize that has lodged does not rise again as easily as local maize that has lodged. Lodging results in severe yield decline as the maize is attacked by soil borne pests and diseases. As Selina Okeyo explains:

*Hybrid maize needs a lot of rain. When there is too little rain it will not perform well. It also needs constant rain. When the rain disappears before it matures, it suffers a lot compared to local maize. From my experience, maize should be planted between 15th February and 15th March, as there is normally a heavy wind from Western province around June. So if you plant early, by June the maize is stronger and it has already pollinated so even if a few plants lodge the damage will not be so high as when this happens in an earlier stage. Hybrid maize does not withstand this wind. It lodges easily even when there is only a light wind blowing. Local maize is very stable and does not lodge easily. Local maize will bend only a little and will struggle to stand upright again. Local maize also produces extra prop roots which make it anchor strongly in the soil'.*

Selina grows both hybrid maize and local maize. During the short rains she grows only local maize. She fears that local maize does not like too much rain though she thinks it is nevertheless the most suitable variety of maize in this region. She likes growing Ababari a local white maize variety, which she gets from a friend. She tries to rotate the various varieties of maize. Sometimes she grows Uganda white. Before starting growing H625 she grew H622, but she says it grows tall and lodges easily. It also opens easily and starts to rot when it rains. She compliments fertiliser with farmyard manure from her zero grazing unit, so she does not have to buy the exact amount of fertiliser required per acre.

Other features of hybrid maize that are complained of are its low resistance to pest attack particularly storage pest and stalk borer which attacks it in the field. It has also low resistance to diseases like rust and maize streak. It shows very low competition to weeds like couch grass and is seriously prone to striga weed attack. In the presence of striga, hybrid maize yields lower than local maize. Thus an important feature of hybrid maize is that any sudden change in its ecology lowers its yield markedly compared to local maize. Local maize is more resistant; it can still produce something. Most resistant are local yellow (*nyamula*) and local red. Maize streak, a virus disease that is transmitted by leafhopper caused serious crop failure among farmers who grew hybrid maize in 1996. Though local maize was also attacked, farmers managed to get some yield higher than those from hybrid maize fields. Hybrid maize is less resistant to suddenly changing weather conditions. Furthermore, when it comes to resistance to storage pests, its grains are not as hard as those of local maize are as such it suffers high pest attack. These reasons made some farmers to distance from hybrid maize and turn to growing local maize.

Esther Olawo and her friends Susana Serwa and Abigail Ochuoga stated that local maize stores better than hybrid maize.

*If you use ash from burnt dry cattle dung or from burnt dry sedges from swampy places to dust local maize, you can store it for one year with very minimal weevil attack. However with hybrid, the seeds are not hard and weevils will attack them all within four months if you use ash.*

Abednego Ochieng, once a hybrid maize adept, has developed a preference for local maize. If he grows hybrid maize, it is just in a small portion in his field but not regularly. One day when I was helping him shell his Uganda white maize, he gave me his reasons for withdrawing from growing hybrid maize.

*'... it demands a lot of labour, which I do not have. I told you that my biggest problem is capital and famine. I have also to pay school fees for my children and you can see for yourself the condition of my house. I am saving money to build a new one. Thus with little labour it is not advisable to engage in hybrid maize. It is also more vulnerable to pest attack ... It cannot tolerate the striga weed infestation prevalent here. Hybrid maize is not very resistant to sudden changes in weather conditions. If you keep on growing hybrid using fertiliser without crop rotation, finally the fertiliser spoils your soil. farmyard manure is better than fertiliser and suppresses the growth of striga weed. Hybrid maize lodges more than local maize. The stalk is weak compared to local maize. When they lodge they are exposed to attack by soil born pests and diseases. It is not sweet and is less tasty than local maize. Pests attack it more when stored and in some hybrid varieties, like H632, the cobs open and start rotting before they reach maturity. Another serious problem ... is that the quality of hybrid maize seeds has deteriorated. The Kenya Seed Company opened branches in South Africa and Uganda. Then they had to conquer new markets and that is where the maize seeds are going. The worst seed remains in Kenya where they already have a market'.*

These are the reasons why Abednego has opted for security crops such as cassava, sweet potatoes and sorghum, which are all drought tolerant. He did very well when he started to plant hybrid maize in the 1970s because he was getting support from free tractor services, fertilisers and seeds from the Ministry of Agriculture and his plots were used as demonstration plots by extension officers. KARI research officials also used his plots for on-farm trials. They came with the necessary inputs and paid for labour to manage the hybrid maize. When the fertiliser subsidy was withdrawn, the tractor hire services ran down, and researchers and extensionists stopped using Abednego's plots for demonstration and research, Abednego could no longer cope with the demands of Hybrid maize management.

His brother Oketch Bundmawi is concentrating only on local maize and other traditional crops like sorghum, finger millet and sweet potatoes. When asked if he has abandoned hybrid maize, he replied,

*Not completely. Actually it is not a question of abandoning hybrid maize but more what suits us best in most aspects. In hybrid maize, people are talking about high yield as the main reason why we should take it up. But what if we discover also a local maize that yields as high but requires low input. We would definitely go for the local maize. Personally, there are certain features of hybrid maize that make me not go for it .... [what I] tell you are my own personal experiences and nothing to do with farmers elsewhere. First, hybrid maize needs a fertile land. If your land is not fertile, then you have to use a lot of fertiliser and possibly in combination with farmyard manure to ensure a good harvest. For poor farmers like us, we do not have sufficient money to buy these inputs.*

*He went on to mention the low resistance to diseases and inability to withstand striga weed infestation (mentioning local yellow (nyamula) and local red as being particularly resistant), and the problem with hybrid maize of having to buy seed each planting season and as many others mentioned - lodging, its late maturing, and the cobs opening before being completely mature and the consequent damage from birds and other pests such as rats and termites eating the fallen maize and the cost of pesticides. 'Taking these into consideration', he said, 'it is very well possible that a farmer will gain less in growing hybrid maize than local maize.'*

One day there was a leaders' tour throughout Yala Division. Chiefs and their assistants joined the leaders from the district headquarters to assess development in Yala Division. I had a chance to interview Oketch again about his tour, since almost all the leaders expressed surprise at how few people were growing hybrid maize. Oketch repeated many of the reasons already given above for this and added,

*'[wastage] rotting from one acre of hybrid can be as much as go up to 2 bags. Physically you might think that hybrid produces a lot but when working out a cost analysis, then .. local maize is better. Security crops should be encouraged ... Macro research is sometimes very ineffective because of large areas covered. Since we can have microclimates, we need micro research. Research should produce a cultivar that is suitable for the smallholders (70% of Kenyan farmers). The cultivar should be resistant to sudden weather change, pests and weeds, production should be high even when the soil is not fertile, no lodging and a variety that does not suffer when there is a lot of rain at harvest time.'*

Since hybrid maize performs poorly in less fertile soils, the degraded soils in Siaya district is a reason for distancing. As pointed out in chapter two, overpopulation has forced farmers in Siaya to drop the fallow period and to cultivate their small plots every season. This frequent tillage, combined with the lack of organic manure from the reduced cattle numbers, has resulted in exhausted and degraded soils that are often prone to erosion. Households know that continued heavy use of fertiliser spoils the soil by negatively altering its texture. The upper part of the soil becomes very fine, the soil particles become very small and the soil becomes prone to erosion. In the lower part of the soil a hard pan is created. They state that without fertiliser hybrid maize cannot produce more than local maize, if indeed as much. Another negative effect of fertiliser is the fact that the soil becomes, as it were, addicted to fertiliser. Once used, fertiliser has to be continuously applied, otherwise yields decline enormously in the subsequent growing seasons. And it is believed that fertiliser application stimulates the growth of striga weed, a parasitic weed that attaches its roots to the roots of maize and draws nutrients from it. Selina Okeyo believes that the best way to avoid erosion and striga is to use organic manure. 'Scientists', she claims, 'have failed to come up with a chemical we can use to control striga. So as well as using farmyard manure, we just uproot and burn them'.

Oketch Bundmawi uses no inorganic fertiliser on his fields despite his being a civil servant and able to afford it. He considers its use to be uneconomical.

*If you calculate the profit of using fertiliser from the market and using home made organic manure, you will find that home made organic manure is more profitable. First organic manure is cheap and affordable to poor farmers. The resources for making it are locally available. It stays in the soil for a long time unlike industrial fertiliser. Industrial fertiliser is like 'tea' which you have to keep on giving the crops every season. The soil becomes addicted to it and without it, the yields reduces. Homemade manure improves soil structure. It does not spoil the soil like industrial fertiliser, which makes it waterlogged by leaving some residues. If you use DAP for 4 or 5 years, you can use 4 bags per acre (200Kg) and still end up with not a very high yield. This is because after sometimes it changes the soil texture. We should farm for profit and not for subsistence. This we should do using locally available resources (available farm inputs). For example Tithonia diversifolia (wild sunflower) weed which grows locally and forms hedges along the farm boundaries can form a very good compost manure or green manure. Tithonia does better than inorganic fertilisers. When we use organic manure then we will do better and we will also be able to control our environment'.*

#### *Socio-cultural issues*

The third group of arguments focus on the cultural elements that inform and shape agriculture. An issue concerning quality and values and colour is reflected in the notion that porridge (*ugali*) from hybrid maize is light and less satisfactory to eat as that made from local maize. The women, in particular, argue that *ugali* made from hybrids requires twice as much maize as *ugali* from local maize and that:

*'it does not satisfy children easily. Children need to eat more of it. Local maize is tastier than hybrid maize when roasted or boiled because it has a high starch content and when at the milk stage the grains have higher amounts of sugar.'*

Colour is also brought forward as an argument in favour of local maize. A second issue is that hybrid maize has never fitted the Luo custom of first sowing and first harvesting. It has never become over the years 'family seed', and is therefore seen as being incompatible with Luo cultural repertoires. It has remained always an outside seed (*nyareta*).

Local maize is seen as tastier when eaten green and as for being heavier, Margaret Odera also mentions that most farmers are going back to the growing of sorghum and finger millet because they are heavy when eaten and sustain one for longer periods than maize. Margaret also grows cassava.

As mentioned, Luo culture is seen by some as incompatible with hybrid maize management. The principle of seniority, *golo kodhi*, has already been discussed (see Chapter 3). This means that if an older person is delayed in sowing the younger members of the homestead or the lineage also has to wait. When there is a substantial delay younger members that had planned to sow

hybrid maize on their plots might be forced to sow early maturing local varieties. Some are put off hybrid maize because sometimes the senior persons in the lineage can decide to delay planting in order to punish them, and this is serious in relation to hybrid maize.

Furthermore, hybrid maize cannot be used for planting first. This is mainly done with millet or sorghum. The seeds used in this cultural practice are normally family seeds while hybrid maize seeds have to be bought from outside, in the shops. Local maize will therefore be preferred.

Despite her Christian background and a home where most people are elite and wealthy, Selina Okeyo observes the Luo tradition of *golo kodhi*. The reason she grows local maize is because she likes to observe this ritual, though she does not believe the ritual hinders growing hybrid maize, since the delay is usually only a two to three days' difference.

*'If I was to live with my late co-wife, I would always allow her to plant first. Even my children, I always make sure the younger ones have respect for the older ones. This is the only way people can live peacefully. All we need is to bring seminars closer to the people so that elder people can also attend and be briefed on the advantages of early planting. The problem of early planting actually has come up with maize. Most old people do not plant early before it rains because soil born pests might eat the maize seeds. Long ago, by 15th February, old people would have planted their millet. This they did with or without rain. Millet can stay for long time in the soil without getting spoiled while waiting for rain. The way it is now it might impede development because some elder people are just jealous. They do not want to plant early enough, pretending that they have to wait for rain. This did not use to be the case. Particularly chief Odera Akango would order the elders a day after meeting the rainmaker to perform golo kodhi. Malingerers were caned thoroughly by Chief Odera's soldiers on his order. Luo tradition of golo kodhi does not interfere with farming. We are interfering with it ourselves. For instance if an elder has to plant first he/she can also plant just a small corner of his mondo so that the rest can start. But sometimes elders use their right to plant first to show other family members that they are in-charge. Sometimes they are jealous that the maize in our farm is doing well and we are bound to get a good harvest so they will block us from harvesting in time. Meanwhile thieves will be stealing our maize'.*

Selina also knows that not observing custom would lead to people talking ill of her and start gossip about her and her husband's wealthy status.

Ochieng Monye was always in conflict with members of his family over *golo kodhi*. In chapter three we saw that, as a result of shortage of land and economic problems, sons tend to stay longer in the homestead of their father, in many cases even after they have married. These sons then remain subjected to the power wielded by their fathers, the *jaduong dala* and to their elder brothers still living in the homestead.

According to Yiengo Rateng, an alternative to this nowadays is for one to buy the seeds from the market and plant in the field directly without bringing them to the homestead. Yiengo narrates that such seeds were referred to as

*nyareta* (seeds from outside) and could not be used to brew beer in the harvesting ceremony for the elders. To brew beer you had to use grains of the previous year's season and these grains must come from the family seeds. But when we reminded Yiengo about the stores being empty and that these grains are cleared before the next season's harvest, he told us that it is one of the reasons that the *fwachra* feast is nowadays being skipped in some homesteads.

I found the atmosphere between Monye and his father very tense on one interview day. The bitterness had arisen because of *golo kodhi*. Monye had taken the recommendation of the extension workers on 'early planting' and had planted beans before his father. To make matters worse he had planted them in his father's *mondo*. This issue was very serious in their compound and according to Luo customary law it was equivalent to Monye cursing his father to death and taking control of the home. Later, I learnt from a brother of Monye that all members of the family, including his brothers in Nairobi, had to be summoned back home for a cleansing ceremony. A special witch doctor (traditional Luo priest) had to be summoned from the south of Siaya, next to Lake Victoria to come and perform the ceremony. He came with Lake Water, which he mixed with *Manyasi* (a herbal concoction) and melted fat (*wen*) from a black sheep's tail and gave Monye and his father to drink from the same calabash. This way the son and his father were reconciled.

When the long rains start in early February, Abednego prefers growing H626. It is long maturing but it yields well. When the rains come later, he goes in for H622, H614 or H512 or even H511. In the short rain season he grows H512. Abednego stated that, '*my wife is the one who plants local maize variety (Uganda white). She grows it because it is early maturing more or less like the local maize. She reproduces her own seeds*'. Abednego apparently does not seem to be very interested in growing local maize. When I sat down with him during the long rainy season of 1998 I asked him which seeds he was going to use during the *golo kodhi* ceremony. He said he would use Uganda white. When I asked why, he said,

*'I have to follow the Luo customs. I am the eldest son in my father's family and failure to do so might impede the progress of my other brothers in farming as they cannot put any seed in the soil before I do so. Once my remaining uncle Odongo and my mother have planted, then I can also plant followed by my two younger brothers'*.

When I asked him which maize variety he was going to start with given that the maize must be ready before that of his brothers', he answered:

*'In the ceremony of golo kodhi, it is required that you use family seeds. Most people do not understand what family seeds are but today I want to tell you the secret behind it. Family seeds are the ones that were passed on to us by our ancestors. They are the ones that we try to regenerate and in case of any calamity, we can use them to offer sacrifices to the ancestors. They are able to recognise them. Furthermore the first harvest comes from these seeds which*

*we use to brew beer that we offer back again to our ancestors during the ceremony known as fwachra.'*

But, as always with local cultural repertoires, they are sometimes contested and reworked. It seems that if the relation between relatives is good, a solution can more easily be found for solving (some of) problems generated by *golo kodhi*. For instance when the mother of Oketch Bundmawi and Oduor Lomo was delayed in her land preparation activities and therefore could not sow in time, she just sowed a few square metres of maize, after which her sons started sowing their plots. When there are disputes between relatives - and these occur frequently - elders can use *golo kodhi* to display and continue their authority or to punish youngsters who in their opinion do not show respect.

Another cultural dimension of distancing has to do with labour mobilisation. Hybrid maize management is labour intensive. It demands early land preparation, planting in holes made in a line and three times weeding. Many households are female headed, both *de facto* and *de jure*. This means that women farmers work most of the times in the field alone. Their children do go to school and they follow a strained syllabus that requires them to be in school even over the weekend. Furthermore, many farmers complain that children, as a result of education, have adopted a 'white collar' job attitude. Subsequently, they see farming as an inferior activity. This white-collar job attitude has resulted in reluctance to participate in agricultural activities, even when children have no schoolwork to do. This white-collar job mentality also stimulates especially young men and ladies to migrate to town as soon as they can.

In the past those labour problems could be alleviated by *saga* (discussed in chapter 3). However, monetisation of the economy has transformed labour into a commodity. People are no longer willing to participate in this kind of labour arrangement. Therefore, when women who manage farms on their own do not have sufficient capital at their disposal to hire labour, they are normally not able to cultivate hybrid maize.

Patrick Odongo, is a retired primary school headmaster with a long farming history. He blames the lack of labour from the youths to the current syllabus offered in school, which he thinks to be too elaborate.

*'Children have to go to school early in the morning and stay there until late in the afternoon to get all their tasks done. And when they are at home they have to do homework. For that reason children are not able to assist in agriculture. Furthermore, many farmers complain that the youth, as a result of education, have adopted a 'white collar' attitude. Subsequently, they see farming as an inferior activity. He maintains that teachers are the ones killing agriculture by telling their pupils that if they fail to pass their exams, they will go home to dig and miss the opportunity of working in offices. Therefore most youth associate failing with digging in the fields.'*



Labour mobilisation in the research villages is one of the trickiest for farmers. It is not easy to mobilise members of your own kin to work for you in the field whether you have money or not. People are only willing to offer their labour in case of emergencies such as establishing a new home and in funerals or in constructing new schools where the entire community is participating.

### **How farmers distance themselves: networks and struggles**

Farmers distance themselves from hybrid maize by seeking sources of local varieties. This entails making new social networks or revitalising old ones to get knowledge of the varieties and where to get them. Most seeds planted by small farmers come from 'local' sources, which include farmers' own family seeds. I found some farmers in my search for varieties who had maintained their own local varieties and were obtaining satisfactory yields under not very favourable production conditions. This went against the myth of the hybrids and attracted the attention of many people including research scientists and extension workers. Farmers who grew predominantly hybrid maize also often planted a small part of the field with local maize, since it matures earlier and can fill in the pre-harvest gap in food availability. Other sources included grain exchanged at the local level using the established social networks among relatives, friends and neighbours. Such seed is often obtained without cash transactions. Others are local traders in maize grain or maize seed and local seed growers who offer seed for sale. In some areas these collectively form the next most important seed source after farmer-saved seed.

Apart from the tendency towards distancing, a farmer may search for the local maize seed sources for various reasons, e.g. if another farmer field shows the promise of genetic improvements or good quality local maize seed, if a farmer is unable to keep his own local maize seed for technical reasons: crop failure, seed storage problems (e.g. weevils in cereals) and for economic reasons. Poverty may force the farmer to sell his entire harvest. Let us now look at the various social networks that farmers establish in order to obtain local maize seeds after distancing from hybrid maize.

### *Family/Kinship networks*

An important social basis for the exchange of knowledge and goods in the domain of maize cultivation in Luoland traditionally was and still is kinship. Kinship alliance creates very strong ties among farmers. Through kinship alliance, farmers acquire knowledge and goods from their kinsmen. There is a freeness of interaction among kinsmen. In fact, the organisation of Luo society is mainly based upon kinship. Land was owned more or less collectively, by a whole lineage, and land use was decided upon under the leadership of the elders. Furthermore, relatives within a lineage or clan have strong obligations

towards each other. If a kinsman's store is empty and he is in dire need of grains, e.g. during famine period, clan members are expected to help. In cases of need, people are entitled to the surplus, e.g. labour or food, of a clan member. The person, who shares gets a higher status in return. But because of monetisation and individualisation that is penetrating Luo society, these collective responsibilities are starting to change as they are being contested.

Older people in particular exchange knowledge about maize cultivation and about local seed, mostly through kinship networks. In chapter four we saw how James Otieno inherited his 'zero-type' maize from his late mother who left them hanging above the fireplace in her kitchen. Other examples are Selina Okeyo, Margaret Odera and Susana Serwa who stated they learnt preservation techniques, such as hanging maize cobs above the fireplace or storing maize with ash from wood or cow dung, from their parents.

In trying to determine the patterns of networks based on kinship, I found in the villages I researched that almost all farmers knew each other. Their social networks are characterised by an array of links among household members, other kin in the village, acquaintances and other social actors with specific activities in the village. At the centre of the personal network is the household head; around him are the members of his household (family members) who are emotionally and pragmatically important. At this level they decide which seeds to grow and on their obligations. In the event that they do not have the seeds they need, they use existing and seek new networks in order to acquire them. The interactions between households, which we might refer to as inter-household networks, are very strong. There can be many such households in a Luo homestead, particularly when the owners sons are adults and married, since they live in their father's homestead, though as independent households. The same might be seen in a home where the owner is a polygamist. Each woman and her children form an independent household.

In a polygamous compound, sometimes, the different households of wives have their own seeds. Co-wives can refuse to exchange seeds if the *nyiego* (jealousy) relationship is very strong. If the relationship is good, they may exchange the seeds among themselves. However, the homestead head must always have some seeds which he and his first wife use for *golo kodhi*. They try their best to preserve these seeds. This network can then build on to the next order of lineage members of *Jokakwaro*. In this order members of the same grandfather can then seek and secure seeds they need from other members who may have them. This can be extended up to *keyo*, *limbaba* and clan.

After nearby and close kin, the next extension of the network is with distant relatives outside the village, such as with maternal aunts, uncles. Such networks were found to be very strong and as they are linked by blood ties, they link with one another on all aspects of life, even though the relative may

live in another district. They pay each other visits from time to time during which they can exchange and discuss where and how to obtain seed.

In southern and central Siaya, local maize varieties are preferred in the drought prone soils and climate of theirs, where the long maturity of hybrid maize is considered too risky. In these regions, local maize varieties dominated throughout even during the hey days of hybrid maize. Traditional crops like sorghum and cassava were not lost as well. Farmers down south continued planting them. There is a wide diversity of maize varieties in the southern and central parts of Siaya District, with differences in seed colour (white, yellow, red, black and multicoloured), seed type (flint, dent) and maturity period (from 85 days to 120 days). Farmers in northern Siaya where this research was conducted, and had relatives down South or in central Siaya easily got the maize seeds from their relatives through visits.

#### *Neighbours and friends*

Residence in a village is based on kinship, but also upon alliances developed out of strategic considerations. Neighbours are not always blood relatives. Earlier I looked at how *Jadak* (strangers) and slaves (*misumba*) can acquire land from landowners (*weg lowo*). But through the spirit of being good neighbours, farmers help each other and likewise exchange knowledge and resources. Farmers also observe what their neighbours do on their plots and the seeds they grow and may seek their help. This is in accordance with Luo norm of *Chiem gi wadu* (share what you have with your neighbour). Sometimes they discuss their seeds as they walk on each other's field. Ties are strengthened by the fact that neighbours share many things in common in the village - schools, church, shopping centres, springs and streams where they draw water etc.

Selina Okeyo from Nyamnina village obtained local maize (*Ababari*) from Margaret Odera who is her neighbour, not a blood relative. Their husbands are also from different clans. Whenever Esther Olawo had a problem concerning maize cultivation she often turned to Ochieng Monye, whose farm neighbours hers. Often when I visited their fields on Saturday mornings, when Esther was not at school, I would find them discussing farming. Neighbours are useful since they are close when help is needed.

Friends are important social networks outside the kinship network. The majority of the farmers establish relations with other farmers (friends) and learn from the farming practices they each develop. Friends have strong bonds and frequently visit each other for either a cup of tea or mutual help and in this way give and take knowledge and goods, including planting materials. Abednego Ochieng and Patrick Odongo are mentioned as long term better farmers in the research area. Most young farmers who would like to start serious farming try their best to link up with them on a friendship basis.

### Gender

Traditionally, plant breeders and seed custodians are small farmers, and are often, if not predominantly, women. Howard-Borjas (2001: 20) argues that:

*Very frequently, women are responsible for tasks related to seed management, including seed selection, storage, preservation and exchange. Informal seed exchange systems are often female domains, and include mechanisms such as the bride price, gift giving, and kinship obligations, as well as market and barter transactions’.*

This was further confirmed in my research. Within the research villages women had larger social networks than men. Being seed custodians themselves, they knew perfectly well which women to go to when they needed a certain local maize seed. Thus gender formed a very strong basis for social networks for obtaining seeds. As stated before arable farming was mainly women’s task among the Luo until the end of the 19th century. Even though men came to arable farming for other reasons, among them the limited options for securing off farm income, women still remain the backbone of arable farming in the region. Women also establish friendship networks (often fellow women) and visit and help with work on the farm and in return are given seed from the crops being grown. For example, Abigail Ochuoga gave maize seed of her local *radier* to six other women, not to men. One of them was her daughter Pamela Oluoch, the wife to Oluoch Agulu. However, she is careful not to give them people she suspects may spoil her seeds. She also said how she obtained a lot of useful information about maize growing from other women that also do business in Muhanda market, like herself. Esther Olawo stated she often exchanges agricultural ideas with her friend Selina Okeyo. Selina is the secretary of Nyamnina women’s group that facilitates many discussions about agricultural issues. Selina acquired ababari seeds from Margaret Odera, who got from a woman living nearby. She got another local white variety, that she calls *nyaluo*, from a woman who originated from Ugenya, an area in northwest of Siaya District. This woman had married a man in a homestead in the neighbourhood:

*Every time I passed by her plot, I noticed that the maize variety she was growing performed better than mine did. I often asked her for some seeds from that maize but she always refused. After some time she divorced her husband and she disappeared from the area. Just before she did, she came to my homestead and gave me the maize seeds I had asked her for so many times.’*

Knowledge about the majority of local maize seeds was fragmented and more in the hands or heads of the women rather than men. In the majority of farmer interviews it was the women who showed the most knowledge of traditional crops. Crops such as cassava, sweet potatoes, bananas and vegetable crops are still considered women’s crop among the Luo.

*Class*

A fourth basis for the construction of social networks is class. The well-to-do farmers in particular tend to network among themselves. These are the farmers who have the security and finances to experiment. They are the same farmers who can still grow hybrid maize and afford to purchase the inputs required for it. They own exotic dairy cattle and run other businesses in the village. This group of farmers is constituted of retirees from the civil service, from the private sector, teachers, extension workers, and businessmen. Since they do not want villagers to cause injury to their pockets, they prefer to network among themselves. Yiengo Rateng often meets with Selina Okeyo and her husband Okeyo. From them Ogwanjo learned the technique of mixing farmyard manure with fertilizer and applying this mixture in planting holes. Furthermore, as mentioned earlier, Oluoch Agulu claims that he got ababari from Selina Okeyo. James Otieno stated he also talks often with and learns a lot from Charles Okeyo who is also the caretaker of one of his dairy cows on his farm in Rongai.

*Trade*

Trade can also be considered a basis for social network construction for obtaining knowledge and goods in the domain of local maize cultivation. Most farmers buy the local maize they grow from traders at the market centre. Resource poor farmers had serious difficulty saving their own seed and often have to rely on the food grain market for their seed needs. 'After a bad year farmers have to plant any seed they can lay hands on'. Farmers have developed networks and systems of ensuring a sustained supply. Seeds are exchanged in local markets, where an assortment of varieties adapted to different environmental adaptations is available. Inter-regional exchange is also important and farmers know where to locate new supplies of seeds when traditional landraces become degraded. In Siaya District, there are well-established market centres where farmers can obtain local maize seed. Big market centres such as Yala, Ngiya, Ugunja, Uholo, Boro, Bondo and Akala offer farmers the opportunity to trace lost local maize seeds from farmers who still have them.

In 1982, famine called '*gorogoro*' occurred in Siaya. Since there was an enormous shortage of maize, farmers crossed to Uganda to buy seed. Local maize such as Uganda white came to the research villages through this network. Farmers who planted it were pleased with its performance, and it is now very popular in the area. Traders like Yiengo Rateng and Oduor Lomo travelled all the way to Budadiri in Eastern Uganda to buy maize. Maize is very cheap there as it is not a staple cereal for most Ugandans, who prefer bananas. Also in Eastern Uganda, traders managed to network with the

Padhola, who are kinsmen to Luos, and speak the same language. This enhanced the close ties between them. A lot of knowledge was shared in this case. For instance, the Padhola use neither hybrid maize nor fertiliser in their fields. They state that fertiliser spoils the soil, a phenomenon the Luos had also discovered.

*Community organisations:*

The main production objectives of small farmers in the research villages first are to ensure self-sufficiency in food production. Cash is not their main objective for production. Most decisions are characterised by trying to avoid risks. This is the dominant management strategy. Due to the social relations each household has with the wider community, whatever they decide is influenced by this relationship. These households are involved in activities both inside and outside the farms. In my research villages, women's groups formed the majority and through the groups women met frequently to discuss a wide range of issues of concern to them, including farming. In this way they exchanged knowledge about the various crops they were growing and they compared performance.

The ties between farmers and the community are strong. Community alliances, including informal knowledge networks such as farmers groups, mainly women's groups, dominate the region. The link between farmers and these groups as a source of knowledge for redesigning is important. Farmers exchange labour among themselves and help each other as a group. During this time they discuss the hybrid maize technology package vis-à-vis local maize. They disseminate new ideas on dairy farming and within this we have also social influences exerted through social norms.

In seeking options for survival, farmers draw upon bodies of knowledge from groups of agencies, which help them with adaptive change, such as CARE-Kenya and On-Farm Productivity Enhancement Programme (OFPEP) that are NGOs carrying out an adaptive research on local maize. On realising that farmers were increasingly moving away from hybrid maize, they helped farmers to form study groups in each location in Siaya district to facilitate and enhance their capacity to carry out research on their local maize. Together with farmers they began to screen several varieties of maize, including hybrid maize grown in the region, with a view of ascertaining their performance under various conditions. Farmers were then left to make choices on which varieties to grow. Sometimes they also brought local varieties of maize that had almost disappeared in the region for trial.

Farmer-to-farmer exchange of seeds is effected through barter, gift exchange, borrowing and of course, through sale. There is no restriction on the exchange of seeds and information among members of the same or different social

organisations. A farmer can also obtain seeds in return for labour. It is this living tradition of mutual interdependence that sustains local seed supplies though limitations have been reported elsewhere with regard to speed and range.

*Struggles to maintain the genetic base of local maize*

Apart from establishing social networks to acquire local maize seeds, farmers also try to establish a defence line to protect existing local maize from getting spoiled by hybrid maize through cross-pollination. Abednego Ochieng made the following remark to me one day,

*'The current local maize is no longer local due to cross-pollination. The hybrid maize I planted this season, I decided to plant it far from the Uganda white. Uganda white is doing so well here and I would not like it to be spoiled by hybrid maize'.*

In this case Abednego was referring to genetic erosion that takes place as a result of cross-pollination. It is a phenomenon observed by most farmers. Many mentioned how hybrid maize spoiled other maize varieties when planted close to one another. Mostly old farmers who have quite some experience with these two types of maize complain of this and some have even developed strategies of how to deal with the situation.

According to one plant breeder from KARI, the term genetic erosion includes two different processes: 1) Cross-pollination with a plant of differing genetic constitution results in the disappearance of genotypes. 2) Increased dependency on producing marketed surpluses resulted in a bias toward the use of hybrid varieties in the 1960s and 1970s and this led almost to the disappearance of local composite varieties.

First let us discuss these two processes of genetic erosion and then examine farmers' awareness and responses to them. Local maize varieties cultivated close to fields of hybrid maize, cross-pollinate. The first two to four rows of local composite maize will be pollinated by the neighbouring hybrid while flowering. When harvesting the local maize varieties, the cobs are mixed and transported to the household store. Mass selection of seed for the coming season is done from the stored maize and part of the selected cobs will be the cross-pollinated seeds. Cross-pollination from hybrid to local composite maize changes the characteristics of the local composite variety as it adopts genes from the hybrid. One important characteristic, which may change, is the ability of the local composite to mature early.

The hybrid varieties available in the northern highlands of Siaya demand a minimum of 150 days from planting to maturity and the local composite varieties only 85 to 120 days. It is therefore a management practice among farmers in Siaya to plant the local maize immediately after the first rains and then follow with hybrid maize a little later so that by the time the hybrid maize

tassels, the local maize has tasselled and pollinated itself. They then conclude by planting local varieties again in the end depending on time and availability of land.

According to the plant breeders from KARI Kakamega, genetic erosion reduces the yield of hybrid maize and local maize by 25%. Mr. John Ndugu of KARI-RRC Kakamega calls it 'genetic depression'. Genetic erosion is less widespread in the semi-dry areas of Siaya since the diffusion of hybrid maize is more limited than in the high potential areas of Siaya district. But the effect of genetic erosion on food security may be greater, as farmers here are highly dependent on early maturity of the local composite maize varieties.

In trying to determine awareness and counter-action to genetic erosion by farmers in Siaya, the following results were obtained. The process of genetic erosion through cross-pollination is well understood by most farmers and awareness is growing as it becomes a more serious problem. Old farmers in particular have developed methods to reduce cross-pollination and maintain local composites in more pure forms. Some avoid cultivating hybrid and local maize close together. Joseph Ogwanjo whose son is an extension officer told us that his son, Kanji, had taught him how to separate the two varieties of maize in order for them not to spoil each other.

*'To be able to avoid the local maize being spoiled by hybrid maize, I have decided to plant my local maize in the plots nearby. But my farm far off, next to the river, I have decided to plant hybrid maize. However, many households would not be able to do so because of limitations of land. Fields are often small and cultivation is intense in the vicinity of the village settlement area.'*

Some farmers who understood the problem but did not have the means to separate the two varieties took a different option, that is, isolation by time. If both hybrid and local composite varieties are planted at the same time, the local maize will end up flowering before the hybrid and cross-pollination cannot take place. This method, however, is also difficult to practice for many farmers due to resource constraints.

## Conclusion

The outcome of hybrid maize breeding and selection was the development of specific types of maize seeds with a narrow genetic base that were believed to be high yielding and superior to local maize. A major characteristic is their increased responsiveness to fertilisers. Another is the longer maturing period, which constrains double cropping. The cost of production per unit of land also increases as a farmer moves from traditional crops to high yielding maize technology; the justification of the additional cost according to researchers and extension workers being that it would be exceeded by the additional return from increased production. This implies that farmers become increasingly



dependent on the market for the supply of inputs. Unlike 'traditional' cultivation where the farmer uses last year's seed for cultivation, uses either farm yard manure or no fertiliser at all, and uses family labour, the new technology makes farming dependent on the market for the supply of new seeds, chemicals, fertilisers, pesticides, herbicides and hired labour for harvesting, sowing and other operations.

There are several reasons why Luo farmers took up hybrid maize. Next to the subsidies to purchase fertilisers, the availability of hybrid seeds and fertiliser through a dense and active network of traders and stockists and the delivery of extension services, its association with modernity surely contributed to its adoption. The uptake of white maize (including hybrid maize) was highest in what is now Yala Division where the research villages are situated. The climate in this area, with moderate amounts of rainfall compared to the southern part of Siaya, also favoured the cultivation of hybrid maize. Another important element contributing to the spread of hybrid maize was the perceived profitability of the crop. Farmers believed that the average yield gap between hybrid and local maize was wide enough to finance the monetary inputs for hybrid maize and make a good profit on top of that. More so the National Cereals and Produce Board depot that for long offered a ready market for their maize was situated in Yala town, some six km from the research villages.

It should be noted, however, that in contrast to other areas in Kenya or in Western Kenya, the adoption rate of hybrid maize in Siaya district was never very high. In 1973 the uptake for the whole of Siaya was still below 20%, while in the same year districts like Trans Nzoia, Nandi and Kakamega had reached an adoption rate of almost 100% (Gerhart 1976: 27; Hebinck, 1990). Most farmers in Siaya district decided not to adopt the presented hybrid maize package, and those who decided to adopt the technology package, in most cases did not adopt the total package. They adjusted and redesigned the package in many different ways.

The main reason why farmers redesigned the technology package was that it was insufficiently adjusted to local circumstances. Farmers lacked land, labour and the financial means to internalise the package in its original, prescribed form. Furthermore, the cultivation of hybrid varieties was not always compatible with the Luo principle of *golo kodhi* and the social relationships in which this is embedded. Moreover, farmers themselves found out that the five series hybrid varieties were suited for the northern Siaya short rainy season. The government did not yet have a policy for the short rainy season.

Three broad aspects were identified that explain the reasons that farmers distanced themselves from hybrid maize and turned to growing local varieties.

These aspects are market-cum-institutional failures, agronomic values, and the cultural repertoires of the Luo.

The issues related to market-cum-institutional failures pivot around the quality of relationships between maize cultivation and the sets of institutions like the market. One of the arguments put by farmers for distancing themselves from hybrid maize concerns the high costs of inputs such as maize seed and fertiliser. Such inputs are expensive in relation to the input price for traditional varieties and also to the average income of farmers in Kenya. The lack of capital to purchase inputs and a lack of credit facilities to enable farmers to invest in their farming practices were also advanced as reasons. The AFC had the task of issuing credit to farmers; but largely because of bureaucratic formalities associated with their functioning, a large part of the modest amount available to Siaya farmers was not disbursed; many farmers, particularly the poor and landless face institutional difficulties in gaining access to credit. Similarly, rigid lending practices followed by the land mortgage banks and commercial banks, particularly their insistence on security, made it almost impossible for poorer farmers to get financial support for buying inputs. The unavailability of inputs and the perceived deterioration in the quality of inputs, especially seeds, but also fertilisers, was also mentioned as a reason to distance themselves from growing hybrid maize. Farmers express a general distrust of the market.

A second group of arguments hinge around agronomic issues, such as the characteristics of hybrid as compared to local varieties. Farmers claimed that local maize out yields hybrids, especially when only farmyard manure is used to fertilise the soil. In close association with this, farmers spoke of problems related to lodging, to cob rot and bird damage, to their lack of resistance to weeds, pests, diseases and suddenly changing weather conditions, and storage problems. A second series of agronomic arguments hinged around soil fertility and the application of fertilisers: 'fertilisers spoil the soil', and 'the soil becomes addicted to fertiliser', and 'fertilisers stimulate the growth of striga'. Since hybrid maize is fertiliser responsive, these adverse effects of fertiliser in the soil are a strong argument for distancing from hybrid maize.

The third group of argument is cultural in nature. Porridge, the staple diet (*ugali*), made from hybrid maize is light and less satisfactory than *ugali* made from local maize, and it is less sweet. In addition, local varieties are excellent when boiled, and roasted, qualities that hybrid maize does not have. Colour is also given as an argument in favour of local maize. A second issue has to do with the cultural dimension of labour. Hybrid management is labour intensive and due to the commoditisation of labour, labour is now expensive and hard to get since kinsmen no longer want to work for one another. Labour is also scarce because of the out-migration of men and the school enrolment of

children. A third issue is that hybrids have never been in tune with the Luo custom of first sowing and first harvesting. Hybrid maize is seen as an 'outside' seed, unlike the 'family' seed, as local maize is perceived, and therefore perceived as incompatible with Luo cultural repertoires. The fact that presently sons tend to stay longer in the homestead of their fathers has increased the influence of 'traditional' Luo customs like *golo kodhi*.

This chapter has also revealed that farmers distance themselves from hybrid maize by establishing socio-technical networks to acquire both local seed and the knowledge about it and other traditional crops suitable to their socio-cultural environment and the local ecology. Network analysis has shown that farmers are not only recipients and reproducers, but are also creative managers and integrators of knowledge and information from diverse sources, including family members, kinsmen, friends, neighbours, traders, and intervening agencies that have taken a different position from the state extension workers and the community. The 'saved' family seeds of local maize became handy when they started distancing from hybrid maize. In most cases the socio-technical networks farmers establish to acquire local maize are not governed by commercial motivations, but rather are embedded in mutual interdependencies and trust. Farmers benefit from such networks, for seed - particularly during times of drought, for the renewal of degenerated seed and for the adoption of new varieties. Sometimes resource poor farmers secure seeds in return for their labour. Seed exchange among farmers too ensures conservation of a wide genetic base.

After distancing from hybrid maize, farmers have to continue protecting their local maize from genetic erosion. The variation in maturity period between local maize and hybrid maize is used as a way of evading genetic erosion. Another way is spatially separating the two maize varieties. Farmers, as this chapter has indicated, are researchers in their own right, with the propensity to experiment.

The chapter has shown that technological change pushed by the hybrid maize regime does not fit local conditions, practices and customs. The analysis also indicates that technological change is neither a straightforward nor linear process and highlights that technical change necessarily needs to be understood as socio-technical change. Based on all these arguments, we may also conclude that the myth of the superiority of hybrids no longer holds for farmers, and especially so for those who have developed more trust in their own local varieties and socio-cultural practices. These social processes constitute the core of the socio-technical niche that has emerged over time in Luoland.

## Soil fertility problematic in Luoland

### Introduction

This chapter introduces the problem of soil fertility and its influence on agricultural development in Western Kenya, including Luoland. The gradual decline of soil fertility is a concurrent issue in the agricultural history of the region. It is now, as in the past, a priority for farmers, government bodies, research institutions and NGOs alike. For farmers it represents a major threat to producing enough food to feed their families. Research, and both government and non-governmental agencies associate soil fertility with environmental degradation, and above all with increasing rural poverty and malnutrition. Both crop and livestock production is seriously affected by the decline of soil fertility (Smaling 1993; RRP 1994; Mulamula 1994; Ogaro *et al.* 1997; Mango, 1999). Many agencies, including the ministry of agriculture and ICRAF have argued the need for a plan of action. What this and the following two chapters address is whether the plans for action have been, and indeed are, effective.

It is generally agreed that the underlying processes at the root cause of the decline in soil fertility is a rapid population growth concomitant with decreasing land sizes, intensification of land use, reduction in fallow periods, erosion, run off and leaching (Smaling, 1993; Ogaro *et al.* 1997; Mango, 1999; de Jager, 2001). But whether, as Sanchez *et al.* (1997) would have it, the traditional coping strategies and soil fertility practices of farmers in Western Kenya have been able to adjust quickly enough to these factors, remains to be seen and is subject to debate. It has been argued that local knowledge and practices in the field of soil fertility are inadequate to deal with current challenges and that plans for action call for an introduction of externally designed technologies that can make a difference. These interventions, however, often neglect and do not capitalise on existing local bodies of knowledge and understanding of soil fertility. There is evidence, also in Luoland, that farmers deliberately use micro-environments, make a considered selection of crop varieties, develop appropriate cultivation practices, and link livestock with crop production in one way or another to maintain and reproduce soil fertility. Richards (1985), Norman *et al.* (1987) and Reijntjes *et al.* (1996), for instance, show that farmers are adept at choosing crop combinations appropriate to the different sites and rainfall conditions that are the most productive even in periods when labour is in short supply.

The issues of soil fertility, which this and the following two chapters try to capture, are extremely complex. This chapter deals with two areas of concern:

The first is a review of the policies and interventions related to soil fertility over the years. The colonial state implemented various policies to deal with such problems, notably since the Swynnerton Plan, but also before that (see Chapter 2). This chapter, then, maps out in detail what these policies were about, and how the Luo responded to them. State policies in this field, such as soil conservation measures, the building of terraces to prevent run off of the top soil, the application of inorganic fertilisers, have not been very successful and at the same time have not always well received by Luo farmers. One might label them contested policies. For example the conventional way to tackle soil fertility, by applying fertiliser, is at present questionable given the lack of cash to purchase fertilisers and/or the unwillingness of farmers to invest in fertilisers given the rather low economic and agronomic returns. Furthermore, the conventional wisdom that fertiliser is an important aspect of soil fertility replenishment is not necessarily accepted, and is much debated. Some farmers would even argue for instance that '*fertiliser spoils the soil*'. In other words, as with the case of maize discussed in previous chapters, the domain of soil fertility is also one where different repositories of knowledge clash.

This process can only be understood by taking account of how Luo farmers themselves perceive soil fertility, how they recognise its decline, and how and with what kind of means they, in a variety of ways, try to tackle the issue. This then brings us to discussing and describing local knowledge in the production and reproduction of soil fertility. In examining farmers' narratives we can also identify some of the constraints of the strategies that they devise.

### **State policies in soil fertility and conservation**

#### *Policies in soil and water conservation during the colonial period*

Kenya was made a British protectorate in 1895, and from 1904 onwards 'white settlers' started to arrive, attracted by the prospect of farming in a fertile country. In 1915, the colonial authorities acceded to the newcomers' demands for secure land tenure and issued them with leases lasting from 99 to 999 years. However, as white settlers appropriated more and more of the land, they provoked an increasing number of conflicts with local populations. In April 1932, the Secretary of State for the Colonies appointed a commission to investigate land use problems in Kenya (Tiffen *et al.* 1994). Its remit were: 1) to consider the needs of the native population with respect to land use and tenure, and assess whether they should be granted communal or individual tenure; and 2) to define the area within which persons of European descent were to be granted privileged position.

In 1939, the 'White Highlands' were gazetted, effectively depriving local people of some 16,700 square miles of good quality land. A dual policy was

advocated to promote both African and non-African agricultural production, but in reality only non-African farmers received support. The dual policy stated that in order to develop the African areas, all able-bodied men must strive to produce a marketable surplus from their holdings. Those who could not do so had to offer their services either to the European farmers, help with construction of infrastructure, or migrate to urban centres (Mbithi and Barnes, 1975). Prospective white farmers were offered training opportunities, low interest loans and direct grants to purchase farming equipment, and could also benefit from government sponsored agricultural research, maize and wheat subsidies, sponsored marketing schemes and transport facilities. Little was done to support African agriculture, apart from enforcing measures to combat soil erosion and compulsory de-stocking.

As early as the 1930s the government had already started formulating ways of conserving the land. There was growing concern over soil erosion and deteriorating natural resources in African areas, which became important enough to influence agricultural policy, even before the Second World War (Lavrijsen, 1984: 40). At the end of the Second World War, there was an atmosphere of crisis regarding the preservation of soil resources in the African areas, many of which had deteriorated visibly during the war. There were public statements, several of them extremely alarmist, but there is no doubt that all of them contained some degree of truth. Translated into policy terms, soil conservation was to be paramount even to the detriment of incomes in African areas, which were bound to suffer as a result. The strategy was to rely on reduced cropping, increased mixed farming', grass leys, de-stocking, physical soil conservation measures, and the rehabilitation of grossly denuded areas. In many areas it was thought that this could only be done in conjunction with the removal of population to new areas of settlement, and these were to be investigated. The intentions were clear and often stated in strongly paternalistic moral tones. However, implementation was not easy (*ibid.*: 40).

The colonial authorities addressed the problem of soil erosion by implementing district level bylaws specific to 'African-held land' and focused on coffee and cotton, cash crops that had been forced upon farmers. Farmers were not allowed to plough steep land, cultivate along stream channels or clear forests. Outside policies encouraged contour farming, tree planting on hillsides, terrace strip cropping and the destocking of herds, and certain areas were closed off to prevent grazing (Tiffen *et al.*, 1994). Local chiefs, headmen and technical assistants were employed to ensure that these policies were followed by the rural population (Thomas *et al.*, 1997). The local administration and agricultural officials rigorously enforced these stipulations and stiff penalties were imposed on farmers who failed to comply. For 'non-African' farmers in the high potential areas of the Kenyan highlands, the assumption was that they

were aware of the soil erosion problem and only needed advice on the soil conservation order from the District Commissioner, which required the occupant of the land to either adopt the specified measures or stop a specified activity.

Jaduong Wasao, a retired extension worker who served during the colonial period told us that it was obligatory for people to dig terraces on their farms to stop soil erosion.

*'Bush clearing, soil conservation, then land preparation. It was forced labour. This was the beginning of the hatred of manual work on the farms by youthful Luos. Most of them responded to this by taking off to work on white settler farms rather than be forced to work on their own farms. Some reciprocated by taking refuge in mission boarding schools. These laws were not relaxed even after the Swynnerton plan published in 1954, which also encouraged the consolidation of scattered plots and individually registered titles.'*

Compulsion made soil conservation measures thoroughly unpopular. Jaduong Ogwang Madara an old farmer from Muhoho village told us that the period of the late 1940s-1950s are still remembered by them as a time of great hardship and government harshness. Compulsion and mistaken technologies created hostility, which the agricultural extension service could only slowly overcome. As farmers were then reluctant to maintain the structures, the policy failed in the longer term. Most knowledgeable old farmers who were then the opinion leaders, like Ogwang Madara narrated that

*'The government orders that were issued at that time in all sectors were coercive and the opinion of most people were not sought. We were to do as the District Commissioner directed. He was the governor's representative in this region and had a lot of powers. Our views were not sought on anything. Most people also believed that the colonial government promoted soil and water conservation measures as a means of appropriating their land as had been done in Central Province. Also, insecurity of land tenure made farmers reluctant to construct terraces. Ox ploughing became difficult with bench terraces running across most farms. However we had to construct them as failure to do so led to heavy fines by either confiscating our cattle or being forced to go work on the white settler farms.'*

The struggle for political independence started in earnest in the late 1950s, finally leading to independence in 1963. Pro-independence politicians campaigned strongly against compelling people to construct soil conservation structures in their farms.

Researchers and extension workers who were interviewed about colonial policy on soil and water conservation (SWC) stated that it was a good policy because it was specific. According to Kanji, an extension officer,

*'The problem was that they enforced compliance, and there was no deliberate attempt to explain to people the importance of the policy. Furthermore, post-independence euphoria spoilt it, as its implementation slackened. While it was still enforced, soil degradation was minimised.'*

His father, Joseph Ogwanjo, who went through the system at that time and was one of the young men who took off to town to avoid being forced to dig terraces agreed that the policy was enforced without its importance being explained.

*'The SWC policy, like other colonial policies, came from nowhere, and the farmers saw it as beneficial to the colonists only. The short-term benefits of the SWC policy were not clear to us although the colonists knew why they wanted it. We abandoned it as soon as chiefs stopped enforcing it'.*

#### *Soil and water conservation policies after independence*

The Luos like other communities in Kenya, having associated soil and water conservation measures with colonialism, either cut down their conservation activities or distanced from them altogether after independence, leaving the structures to disintegrate. Soil erosion consequently increased, causing such concern that a land use commission was set up in 1970, under the instruction of President Kenyatta, to address the increasing degradation of natural resources in the entire country, but it made slow progress.

A similar, but more successful initiative was the National Soil Conservation Programme, launched in the 1970s with support from the Swedish International Development Agency (SIDA). Its objective was to increase and sustain agricultural production by introducing simple, cheap and effective conservation measures that could be carried out by the farmers themselves. The focus was on individual farms. Volunteer farmers were given extension advice and expected to adopt whichever SWC measures they felt appropriate. However, this approach was perceived as slow and ineffective, and there was little consultation with farmers beyond the initial extension phase.

In the 1980s, the Ministry of Agriculture, Livestock Development and Marketing adopted the Training and Visit (T&V) system to promote soil and water conservation techniques. However, extension agents were so overworked that they were barely able to give adequate conservation advice to farmers, let alone support for planning, surveying farms and installing conservation measures. Nonetheless, this approach did have a more positive impact than the former individual farm approach.

T&V was replaced by the 'catchment' approach, which entailed groups of farmers suggesting how SWC policies might be implemented. With this approach, farmers in selected farming units or clusters (catchments) are involved in diagnosing local problems, planning how to resolve them, and implementing and assessing the impact of SWC work. Participatory rural appraisals (PRA) are carried out with the help of divisional planning teams so that farmers can give their views on the constraints to farming and possible solutions in their area. Their input is then incorporated into the plans for future activities, which are implemented by catchment committees. These committees



work in close collaboration with the Divisional Soil Conservation Officer, who is responsible for co-ordinating the implementation of SWC activities.

The Kenya Soil Conservation Programme, supported by the Swedish International Development Agency (SIDA), has undertaken one of the more successful soil conservation projects. Its positive results have been partly due to the long-term commitment of the Swedish agency, training of the extension service, and the promotion of relatively simple techniques based on local practices, developed at a pace that takes account of local labour constraints. However, evaluations revealed that SWC measures alone cannot improve soil fertility and soil nutrient balances remain negative (Onduru *et al.*, 2000: 9).

With the introduction of the catchment approach, there is a general feeling among extension officials that SWC measures are being planned and implemented in a more participatory manner. However, farmers maintain that conservation schemes still fail to take account of their priorities and knowledge, even when they have been clearly stated during the diagnostic phase of the programme. For example, Luo farmers mention that little has been done about land registration, despite its importance for settling disputes over land and therefore encouraging farmers to implement long-lasting SWC measures such as terracing. Indigenous technical knowledge continues to be largely ignored when new technologies are introduced.

While recognising their value in reducing the loss of topsoil, farmers report that one of the main constraints to SWC practices is the labour required for constructing and maintaining terraces. They also claim that because of the pressures of population growth it is not always possible to follow the recommendations, as more farmers now cultivate steep slopes in an attempt to meet their needs. Some have started modifying terraces to form micro-catchments for bananas. Farmers have suggested that because many of the soil conservation methods (especially *fanya juu* terraces) are expensive and require a lot of team work, other strategies for reducing erosion should be encouraged, such as trash lines and hedgerows.

#### *Mineral fertiliser policy*

The central objective of government policy on mineral fertilisers is to ensure that they are available at the right time, in sufficient quantities and at the lowest possible farm-gate price (Government of Kenya, 1993). Soil science research in East Africa has tended to be strongly biased towards soil fertility and plant nutrition (Muchena and Kiome, 1995). Trials have been conducted on the use of fertilisers, the levels and availability of nutrients in soils, crop responses to different fertilisers, and the use of organic manure since 1925, providing the basis for recommendations on the use of soil amendments on crops. In 1961 these were compiled into a bulletin entitled "A guide to fertiliser use in Kenya",

which later became the keystone of government policy, while the results of the experiments on which the guide is based were used to project Kenya's fertiliser needs.

In 1985, a Fertiliser Use Recommendation Project (FURP) was set up to carry out trials to develop zone- and crop-specific fertiliser recommendations to replace the blanket recommendations made in 1961 (KARI, 1992). Considerable amounts of data on soils, climatic conditions and fertiliser responses were gathered, and less simplistic recommendations were developed and compiled (FURP, 1994). Before liberalisation began in 1991, the main fertiliser importers were the National Cereals and Produce Board (NCPB) and the Kenya Grain Growers Co-operative Union (KGGCU), now known as the Kenya Farmers Association (KFA). The KGGCU had a monopoly on the distribution of the fertiliser aid supplied by donors, while the government controlled and subsidised prices. Importers had to leap over a number of bureaucratic hurdles, the first of which was applying for an import quota. The amount of fertiliser that the private sector was allowed to import depended on how much came into the country that year as aid. After receiving the letters of allocation needed to secure import and foreign exchange licences, successful applicants had to obtain a letter of credit. Not surprisingly, many found this system to be cumbersome, time consuming and inefficient.

Despite fertilisers being relatively cheap, they were not widely used since government intervention in the sector delayed imports, resulting in a very inefficient domestic distribution service. In addition to not always being available at the right time, fertilisers were also often sold in quantities that far exceeded the needs and finances of many smallholders. Another constraint was the profit seeking activities of some government officials (Argwings-Kodhek, 1996: 7). The sixth government development plan (1989-1993) proposed several measures to encourage the use of mineral fertilisers to increase agricultural production:

- 1) Revision of the import allocation system, so that fertilisers became categorised under schedule 1 of the customs tariff schedule, which grants automatic import licences
- 2) Making the marketing system more competitive and increasing the margins for retail distributors, which would improve the distribution network
- 3) Channelling fertiliser aid acquired by the Ministry of Agriculture through co-operatives and private entrepreneurs.
- 4) Making fertilisers available in smaller quantities, thus making them available to farmers who could not afford to buy in bulk.
- 5) Strengthening the extension system so that it could disseminate information on the right types and quantities of fertiliser, and when to apply it.

### *Liberalisation*

The implementation of the sixth development plan received much impetus from the economic liberalisation started in 1991. The following measures directly affecting fertilisers came into force: 1) Liberalisation of fertiliser prices and distribution. 2) Lifting of import quotas and licences. 3) Lifting of government control over interest rates 4) Liberalisation of trade within the cereal sector. 5) Liberalisation of foreign exchange rates.

Subsidies on mineral fertilisers were abolished along with other government interventions that distorted market prices. A number of tax reforms were also passed that resulted in the upgrading of mineral fertilisers to more favourable import tariff schedules, while some fertilisers were exempted from import duty. However, farm gate prices rose after Value Added Tax (VAT) was introduced in 1993, which, although not levied directly on fertiliser, did increase the cost of transportation. VAT was initially set at 18%, and later dropped to 15%.

Distribution costs vary considerably depending on the mode of transport; road conditions and the distances involved, and seem to increase most sharply between distributor and farmer. They started to rise after markets were liberalised in 1991, but fell in 1993 when the National Cereals and Produce Board was liberalised, making the transport business very competitive. However, transport costs have been going up since then in response to mounting international fuel prices, devaluation and domestic inflation.

Fertiliser prices went up after the local currency was devalued, although the world market price actually remained quite stable. Imports of fertilisers fell sharply in 1995/1996 following the rapid devaluation of the Kenyan shilling. Domestic fertiliser prices fluctuated with changing foreign exchange rates, forcing many new importers to pull out of the market. The price of imported inputs is also affected by the availability of foreign exchange and capital.

A price increase for mineral fertilisers of 40% in just one year was reported in 1999 (Daily Nation, 1999a). Farmers now use less mineral fertiliser than they used to, and some have gone back to using organic manure alone. The government needs to consider its pricing policy on mineral fertilisers very carefully, as it directly influences not only the interests of farmers, but the entire nation through its impact on food production.

### *Perceptions of the impact of liberalisation policies*

Traders from Siaya district are of the view that the effects of liberalisation on fertiliser supply has been less positive than expected. Two stockists interviewed in Yala Township told us that in early 1993, more fertiliser did become available from importers and wholesalers, but this did not last for long. The stockists complain of delays in obtaining the documents necessary for importation and claim that overall nothing much has changed within the fertiliser sector, as

prices are still high and demand has been dropping. They attributed this to the low purchasing power of most farmers in Siaya district, aggravated by persistent droughts in the region, since farmers have no money to buy inputs after poor harvests<sup>1</sup>.

One of the stockists, Mr. Omany Odila, mentioned how they had deliberately started to sell fertiliser in smaller, more affordable quantities, hoping this would enable more individuals to buy. They are also encouraging farmers to bulk-buy in groups and then divide the bags amongst themselves. DAP has consistently remained the most popular fertiliser, but demand is declining even for this input. Horticultural farmers, one of the few sectors where demand has increased, mainly use other types of fertiliser.

The traders we spoke to made a number of suggestions as to how the government could improve the situation: 1) Encouraging investment by providing incentives through investment credit and tax rebates, and strengthening institutions such as the Kenyan Farmers Association. 2) Establishing safety nets to prevent the collapse of the fertiliser market. 3) Re-introducing subsidies to reduce the price of fertilisers. This would make them affordable for smallholders, and subsidies could then be lifted as the market grows. 4) Subsidising the cost of transporting inputs to stockists to reduce farm gate costs.

*Extension workers* believe that the policy on fertilisers has made them more accessible to farmers, as there are now distribution points in even the most remote parts of the district. However, they think that cartels have kept prices high, despite the fact that the many individual players in the private sector price their goods competitively and sell them in smaller, more affordable units. They maintain that the level of fertiliser use in Siaya district is consequently well below the recommended rates, with only about 38% of farmers using mineral fertilisers, and applying less than 20kg/ha (Republic of Kenya, 1998a).

*Farmers* still claim that it is not easy to get hold of fertilisers at the right time even with the introduction of market reforms.

*'Furthermore even if we get them, the quality of the fertiliser is low, unlike the early brands.*

*Extension officers are also nowadays few and as such they are rare. We lack the information of how to use the current fertiliser. Maybe we need to apply a different dose.'*

Extension staff at Yala Divisional office responded to this by saying that the technical information is available, and that the disappointing results are due to

---

<sup>1</sup> Majority of the farmers interviewed supported this view. Weather has displaced farmers and they are not nowadays certain whether they might receive rains within a given season or not. They mention that at least in every two years there is one major drought.

a decline in the quality of fertilisers since liberalisation, as policies designed to maintain standards have not been fully implemented. Other constraints to the use of fertiliser, as mentioned above, included rising costs, inability to get credit, transport costs and unpredictable rainfall. Extension workers further mentioned that farmers seem to regard any farm inputs requiring a cash outlay as costly, even if the technology is profitable. However, Mama Dorcas Kidha, a farmer from Luero village, declared

*'I will not use fertiliser in my plots even if their prices are reduced by half because of their adverse effect on the soil and their poor quality compared to the ones which were being used earlier in the 1960s and 1970s. Instead I will go for farmyard manure from my own cattle shed. I will mix the dung with crop residues which will give me good manure for free instead of spending money on inorganic fertiliser and still get low yields.'*

Most farmers recognise that they can improve their soils by using farmyard and compost manure, and that increasing organic matter is a cheap way of increasing soil fertility and water retention. They would therefore like to see the development of a policy on organic farming and to be taught how to make better use of manure.

## **Local knowledge and soils**

### *Soil classification and soil fertility management*

#### *Farmers' criteria for assessing soils*

Most farmers interviewed base their classification on the surface layer of soil. They codify a soil by colour, texture and heaviness of working. Soils have local names. Some farmers with secondary education will also identify a soil by its English name. Red soil (*Luala* or *Rakuar*) is regarded as the best soil for producing food crops such as bananas, beans, maize and vegetables. It is also used for smearing and decorating the walls of houses constructed from adobe. Red soils with sand are named '*Luala makuoyo*'. They are light and easy to work, but have a lower productivity. Some of these red soils have a plinthite layer and are then called '*Ge*', which is the poorest soil in the area and very hard to improve. Brown soil (*Rabuor*) is also good for growing bananas, beans and maize. White soil (*Pundo*) is used for growing cassava and sweet potatoes and is regarded as the best soil for plastering and decorating houses. Black soil (*Anyuang*) is a clayey black cotton soil, found in swampy valley bottoms. This soil is very rich in nutrients and is used for cultivating vegetables and arrowroots. Farmers prefer red soils because of their high yields. Black soil, which is the second preference, is fertile but heavy and needs draining before it can be used. The third preference is brown soil, which produces average yields. The least preferred for farming is the infertile white soil.

**Table 6.1: Main soil types**

Local name of soil type	Colour	Scientific Classification	Land Use	Management Practices
Luala	Red	Complexes of lithosols, chromic and orthic luvisols and chromic acrisol	Maize, beans, bananas, vegetables	Addition of sufficient organic manure, fallowing
Anyuang	Black	A complex of acrisols, cambisols, arenosols, gleysols, and fluvisols	Vegetables, arrow roots	In valley bottoms; needs drainage and organic manure
Rabuor	Brown	Orthic luvisols.	Maize, beans, kale, millet, sorghum, bananas	Addition of organic manure, fallowing
Pundo	White	Solonchaks and arenosols.	Cassava, sweet potatoes, decorating houses	Fallowing, terracing

*Farmers' indicators of soil fertility*

The term commonly used by farmers to indicate soil fertility decline is "soil weakness". When soils become "weak or tired", yields will decline. Farmers use various indicators to assess the fertility of a field, such as yield, soil colour, compactness, soil odour and the composition of the vegetation. After a period of continuous cropping all these indicators change. The colour transforms from dark red to brown, the odour disappears, and the flora also changes.

**Yield** – If a soil is alive and fertile, then crop yields are high. Farmers mainly assess yields in terms of crop characteristics and performance and less on the amount of crop harvested per unit area of land. The thickness of the ear of maize, the number of tomato fruits and the thickness of cassava roots are indicators of soil fertility. The crops' performance indicates which parts of the plot are weakening. Other crops will then be grown in these spots.

Farmers in Siaya believe that soil fertility is declining, as yields are falling despite the use of some fertiliser. *'I have noticed that I get less maize from the same piece of land than I did 10 years ago'*, argued Martin Onanda (see case 2 chap 3). *'I*

*use manure every year, but not enough because we do not have as many livestock as we did a long time ago'.*

**Colour of the soil** – Farmers associate change of soil colour to poor fertility. However, they could not explain how change of colour is created. Some knowledgeable farmers told me that colour indicates the presence of organic material and varies between different parts of the field. After a fallow period, a soil is usually fertile, having a dark red colour. This shows that the soil has more humus. After a certain period of cropping, the soil colour turns brown, indicating a decrease in fertility. One day I asked Abednego Ochieng (see case 1 chap 3) how he normally detects a fertile and infertile soil, and he replied,

*'The fertility of the soil can be derived from the colour of the soil (darker red is more fertile, light red is less fertile) and the texture of the soil (soil that is more sticky means that the soil contains enough humus and is more fertile than soil that does not stick together). We also detect the fertility of the soil by its compactness. A fertile soil is rather soft and easy to work. This is because it contains a lot of humus. It is also sticky when wet. When fertility declines the soil becomes hard and more compact. Striga has a similar effect on soils. Odour (Suya) of the soil can also tell us if the soil is fertile or not. A fertile soil has a certain suya, particularly after it has rained. Three or four years after clearance and continuous cropping farmers notice that the soil loses its suya.'*

Some farmers, like Yiengo Rateng for example, detect fertile and infertile soil by associating the composition and performance of the weeds and trees growing on a specific plot with the level of soil fertility. Most of the older farmers know which species indicate a higher soil fertility in the Siaya area such as black nightshade (*Solanum nigrum*), pigweed (*Amaranthus hybridus*), and thorn apple (*Datura stramonium*). Farmers identified a high presence of couch grass (*Digitaria scalarum*), white cotton weed (*Xanthium pensylvanicum*), tick berry (*Lantana camara*), poverty grass (*Harpachne schimperii*), fleabane (*Conynza banariensis*), and black jack (*Bidens pilosa*) as some species of weeds indicating poor soils.

### **Farmers' soil conservation and nutrient management practices**

At the beginning of the twentieth century fallowing was the most commonly used method of restoring soil fertility by Luo farmers. Where sufficient land was available, fields were left fallow for many years. Trees and bushes were cut and burnt to release nutrients before the field was cleared for farming again. This practice has declined over the past decades, in terms both of the percentage of farmers leaving their fields fallow and the length of the fallow period, obliging farmers to use other means of replenishing nutrients in the soil. The main cause is that less land is now available for fallowing. An increasing amount of land is being used for cultivation, partly because of the expanding

population, establishment of new homesteads in arable land, and the need to earn more from cash crops. Furthermore, as rainfall declines (increased desertification) and the yield per hectare falls, farmers may try to compensate by cultivating larger fields. The lack of land has also forced them to use more fragile and less productive soils. The expanding fields encroach on pastures and woodlands that are used for grazing cattle and for gathering wood and a range of other bush products. This has a knock-on effect on the ability of farmers to restore the fertility of their soils, for as the available grazing land diminishes so does the possibility to keep livestock and collect a supply of manure.

Some farmers still leave their land for short duration traditional fallow. They believe that "leaving a portion of their land to rest" is the most important way to improve soil fertility. It is also used during labour shortages. Selina Okeyo is one such farmer. Because she has access to extra land from her brothers-in-law who are in town, she can afford to leave a portion of their family plot to lie fallow. She has a 2-acre plot with very big old trees of *Sesbania sesban* that was under fallow for the three years from 1997 to the end of the research period.

Fifteen per cent of the 120 farmers interviewed left their land fallow for at least one cropping season, generally during the short rainy season. Only small portions of their land, representing 10 to 25% of the total area, were left fallow.

As Yiengo Rateng says

*'we are constrained by serious shortages of land, and consequently rely on fallow much less now than thirty years ago. The small areas of fallow that are still present in our region are maintained to provide grazing areas.'*

Although there is some land under fallow, this tends to be a sign of distress rather than positive management, and is largely due to the household lacking sufficient labour, money or animal traction to cultivate their fields. Various research programmes, such as those of ICRAF, are exploring possibilities for 'improved' and seasonal fallow, which involves promoting the growth of selected species of leguminous trees, shrubs and herbs that perform better than indigenous fallow species (see Chapter 8).

#### *Minimising nutrient losses*

The most important techniques for cutting nutrient losses involve a range of anti-erosion measures such as the construction of terraces, or the use of mulch and ground cover. Planting trees or using certain tillage practices may recapture some of the nutrients lost through leaching. Some practices have evolved from traditional methods, but most have been developed recently. Terraces, barriers of *Tithonia* and refuse or trash lines are the most important technologies used in Siaya District.

While recognising the value of terracing in reducing the loss of topsoil, farmers reported that one of the main constraints to using it as a means of soil



and water conservation was the labour required for construction. Some, particularly the older farmers, still link it with the forced labour of the colonial period. They also said that the population pressures prevents following the recommendations, as more farmers now cultivate steep slopes to meet their needs. As mentioned, some have started modifying terraces to form micro-catchments for bananas. Because of the labour constraints involved in digging the *fanya juu* terraces, many farmers are turning to agro-forestry techniques to conserve soil, planting barriers of *Tithonia sp.* and planting trees on steep slopes to help combat erosion. Martin Onanda, Luero village headman, and many other farmers like him have reverted to using barriers of *Tithonia diversifolia* (wild sunflower)<sup>2</sup> along the contours that were surveyed and marked for terraces construction by divisional soil conservation officer. Martin told us that 'Instead of constructing terraces', he said, 'which is more labour intensive, we prefer to plant barriers of *Tithonia diversifolia* on less sloping land. Together with CARE-Kenya adaptive research officials, we have discovered that the leaves of *Tithonia diversifolia* can be used as green manure in the soil and to reduce the labour of transporting them to the farm after harvesting them, we have decided to plant them as internal boundaries in our plots to form a barrier. So *Tithonia* act as a biological soil control measure and at the same time we can cut the leaves and incorporate them in the soil as green biomass manure.'

Farmers use cuttings or seedlings raised in farm nurseries. On steep slopes, farmers first established terraces and then plant *Tithonia* and napier grass to strengthen the structure. Some farmers like Martin just plant them directly without constructing terraces.

Dorcus Kidha is an old woman who can no longer dig the labour intensive terraces and still have time left for land preparation, so she opts for utilising trash lines. Crop residues can be placed along the contour to act as trash lines, which reduce runoff. Some farmers, particularly women, prefer planting sweet potatoes as a cover crop to reduce soil erosion.

#### *Crop residue utilisation and mulching*

Crop residues have multiple uses. Apart from placing them along the contour to stop soil erosion, they can be fed to livestock or used as fuel. They are also an important source of organic manure and most farmers tend to return them to the soil. Crop residues were returned to the fields by 75% of the 120 farmers interviewed. A few farmers burned them to save labour on raking. Of the farmers with livestock, only 10% grazed their animals on crop residues, though some is used for bedding in cattle pens. The resulting farmyard manure is returned to the fields. Very few farmers (about 3%) used crop residues for fuel.

---

<sup>2</sup> This weed is also capable of producing large amounts of foliage that can be used as green manure. See chapter 8 for detailed discussion.

Crop residues are only used as mulch for growing high value crops such as kale, tomatoes and bananas, because mulching is a rather labour intensive technology. It protects germinating seedlings, prevents soil hardening, improves cation exchange capacity and stimulates a favourable environment for microbial activities in the soil. Oduor Lomo uses them together with *Tithonia* leaves as an under mulch. In this technique, he places crop residues in furrows dug on the farm and then covers them with the topsoil to form a ridge. On the ridge he can then grow kale and cabbage seedlings. In this way, he says, when it rots the under mulch improves the soil fertility and water holding capacity and other characteristics of the soil. *'The soil remains fertile and moist even during the dry season'*, he added.

#### *Inorganic fertilisers*

In the 1990s many farmers started distancing themselves from expensive mineral inputs and increasingly turned to applying more organic manure from a variety of sources. Fertiliser was only used by 18% of the interviewed farmers. Those who did use them generally applied less than the recommended rates of 60 kg N and 60 kg P<sub>2</sub>O<sub>5</sub> per ha of maize. They mainly put this down to increased costs, the disruption of services supplying inputs, and the disappearance of agricultural credit systems. Most of these changes are the result of the structural adjustment policies introduced at the end of the 1980s, heralding the end of subsidised fertilisers and government involvement in input delivery and agricultural credit, and the devaluation of local currencies. Some other reasons hinge on deterioration in the quality of fertiliser due to adulteration by traders and the negative impact of fertiliser on the soil. The unavailability of fertilisers at the right time was also mentioned as a restraining factor.

Farmers claim that using fertilisers over time changes the texture of the soil. The upper part of the soil become very fine and prone to erosion, while a hard pan appears in the subsoil. Kanji, an extension officer thinks this may be caused by the accumulation of phosphates in the soil. For three farming households this was the reason for distancing themselves from using inorganic fertilisers and hybrid maize, since hybrid maize does not perform well without fertiliser. Some farmers stated that a soil would become 'addicted' to fertiliser and its continued use is thus necessary to avoid a reduction in yields in the following season. Susana Serwa (see genealogies case 5 chap 3) a farmer from Nyamnina who grew hybrid maize from 1983 until 1990, when she could no longer afford to buy fertiliser mentioned this. She now grows maize without fertiliser but reports very low yields. Four other farmers thought fertiliser application encouraged the growth of striga and two of them had therefore distanced themselves from the use of fertiliser and subsequently hybrid maize.

The extension workers from the divisional agricultural office of Yala Division supported the view that fertiliser increases the growth of striga. According to them, the application of fertiliser, particularly DAP, produces more acid and this favours striga's growth. They also stated that another reason for distancing from fertiliser was the farmers' inefficient use of it. *"The benefits of fertilisers will be limited when farmers use the wrong type, apply too low rates, or use it at the wrong moment."* Oketch Bundmawi (case 1, chap 3) told us that striga has a liking for soils where inorganic fertilisers are used most. It has a devastating effect on cereal crops as it feeds from their roots direct. It is parasitic. Oketch observed that its seeds can stay for long periods in the soil and do not germinate when there are no cereal crops in the field. *'But striga is as patient as a vulture, its seeds can stay in the soil even for a hundred years. The moment you grow a cereal crop, they will then show up.'*

In the past 20 years the rainfall pattern has been changing. Old farmers mention that between 15<sup>th</sup> February and 15<sup>th</sup> March they always used to receive reliable rainfall for the long rainy season. Ogwang Madara said

*'we used to prepare our lands early in preparation to plant around mid-February and mid-March. However in the last 20 years, the rainfall pattern has been changing, making it impossible for us to do proper farm planning. Sometimes the rains begin earlier than expected and sometimes quite late. If we receive a lot of rain in late December and early January, then it becomes quite unpredictable when exactly the rains for the primary planting seasons (Chiri) will begin. Sometimes the rains are delayed until April. Since we have been patterned to plant from 15<sup>th</sup> of February, most of us still plant around that time. But then if we use fertiliser to plant beans, and there isn't sufficient rain, the beans will be burnt by heat from the fertiliser at an early stage of their growth. The entire field of beans turns yellow and subsequently the beans dry up and die. For those who do not use fertiliser, their beans will survive to maturity.'*

This uncertainty in the rainfall pattern and the effect of fertilisers on beans when there is no adequate moisture is one of the reasons for farmers to distance themselves from using fertiliser on beans and some farmers extend this also to maize.

However, the older and more experienced farmers in Siaya wanted to use fertilisers. They claim *"inorganic fertiliser is not bad at all, it only gives the plant ready made food. The problem is the result of poor quality fertiliser<sup>3</sup>. The cost of fertilisers are also too high and we lack finances."* The price of DAP fluctuates between KShs 1500.00<sup>4</sup> and KShs 2000.00 per 50 kg bag, depending on availability. This is quite an investment for a resource poor farmer. Some farmers who have manure and can afford to buy fertiliser will use both when planting their crop. If they do not have sufficient funds, they will use manure at

<sup>3</sup> Since 1991, when fertiliser market was liberalised, most traders have been cheating farmers with fake fertilisers that are highly adulterated

<sup>4</sup> During the research period, 1 US\$ exchanged for KShs 75.00.

planting time and top dress with nitrogenous fertiliser after weeding. The lack of purchasing power and limited access to credit prevents many smallholder farmers from buying mineral fertilisers. Before deciding to use inorganic fertiliser, farmers have to calculate potential profitability and the likelihood of recouping their investment, and the potential risks involved.

#### *Use and management of organic manure*

Farmers in Siaya use organic manure in the form of compost and farmyard manure, a mixture of dung, urine and crop residues. They believe that manure improves soil fertility, reduces the number of striga plants and is effective over longer periods. But they applied on average only 2 tonnes per hectare, much lower than the recommended rate of 8 tonnes/ha. They try to make the best of the limited amounts available through careful application. The recommendation is to apply a handful of organic manure to each planting hole. The availability of manure is constrained by the number of livestock and the tendency to graze the cattle away from the farm. Transporting manure to the fields is labour intensive. Sometimes the quality of the manure is low; not having decomposed well or having lost nutrients due to leaching or volatilisation. The manure is broadcast after the harvesting of the beans and then worked into the soil during ploughing. Almost all farmers interviewed used some organic manure. About 40% of these farmers applied it regularly. The amount applied varied from farmer to farmer depending on availability. When farmers have insufficient manure they will give priority to high value crops such as kale, tomatoes and bananas. About one quarter of this group composted the manure before application. Farmers with no cattle bought manure. One wheelbarrow of manure cost about KShs 15.00-20.00 in Nyamminia village where there are a lot of zero-grazing dairy farmers. Nobody sold manure in Luero village and only one farmer sold it in Muhanda village - at KShs 40.00 a wheelbarrow. Zero-grazing dairy farmers keep their cattle year round in a stable, and accumulate a lot of slurry and manure, part of which they sell.

Esther Olawo, a farmer from Muhanda, has no cattle to improve the soil fertility of her fields and thus she liaises with Ayungo Obongita, a dairy farmer in Yala Township who has excess farmyard manure. He plants no crops and so sells all the manure from his dairy unit. Esther buys his manure and ferries it to her field by ox-drawn cart. Other farmers without cattle, who can neither make nor purchase farmyard manure, use other organic materials to improve soil fertility. These include household waste, crop residues, weeds, leaf litter, prunings and other plant matter, which are left in a heap or pit for some time to compost before being transported to the field. The use of such organic materials is on the increase in all sites, but it is particularly important for farmers with

few livestock. For anaerobic decomposition to take place, the heap or pit must be carefully layered and regularly watered and turned. Various forms of composting were promoted during the colonial period in Kenya and the practice gained new impetus in the 1980s when development projects and NGOs recommended it. It has spread remarkably and is now found in most farms and is used for growing vegetables for sale. However, making compost is labour intensive and represents a considerable investment of time from those involved in producing it - predominantly women and younger people.

The quality of the organic materials used in composting is another issue to be considered. Compost made from crop residues with a limited nutrient content will not have a significant impact on soil nutrient levels. Maria Ambajo, a farmer from Luero village improves the quality of her compost manure by mixing in ashes, eggshells and the droppings from her sheep and goat pen. *'We require an enormous amount of compost and farmyard manure to maintain soil fertility levels in every field. However this is beyond the means of we poor farmers. We lack the time, physical strength, biomass, water during the dry season, and the transport needed to produce and apply large quantities of manure.'* Maria further acknowledged that combining organic materials with small quantities of mineral fertiliser might improve the efficiency of both types of input.

#### *Agronomic practices*

Mono cropping was not a common practice in the research area although it is recommended for growing hybrid maize. Only farmers with sufficient land at their disposal can grow maize in monoculture. Farmers considered crop associations and rotations as better for the soil. Maize is the main staple and thus has to be grown on a large part of the fields. Farmers were aware that leguminous crops (cow pea, groundnut, soya beans) supply 'vitamin' to the soil. Growing an association of different species also stimulates a more efficient use of the soil, saves on land and labour, and reduces risks.

One response to soil fertility decline was to change crop composition. Certain 'demanding' crops, such as bananas and maize, were replaced by crops that perform on soils with low fertility or could improve the soil. These included millet, sweet potato and cassava. Farmers stated that sweet potatoes grow well on depleted soils and that its huge biomass production, in the form of leaves, could improve soil fertility. Moreover, the soil will be turned during the harvest, which, according to farmers, improves its fertility. Leguminous crops are also considered to improve the soil given their production of biomass and 'vitamins'.

*Using intra-field soil fertility variations*

Siaya farmers know when some parts of a field are more fertile or easier to till than others. They exploited these gradations in fertility by adapting plant densities, crop species or intercropping combinations. This resulted in different micro-environments or niches within a field. Areas that were used for human settlements (old compounds or *gunda*) can be very rich in nutrients. They contained the cattle kraals with deposits of manure, decomposed grass thatch from collapsed buildings, lots of household waste heaps and kitchen refuse. They were used for high nutrient demanding crops such as maize and bananas. Farmers may match differences in the nutrient requirements and tolerance to stress of different species and plant varieties with the range of soil fertility levels in their fields. They may even accentuate such differences by concentrating nutrients in certain fields and plots. In addition, nutrients may be taken up from the soil most efficiently when they are applied close to the roots of plants or in planting holes, and at timely points in the growing cycle.

Abednego Ochieng lays out his farm in such a way as to match his crops and varieties to the perceived nutrient status of a field or niche. For example, he says

*'I have grown demanding crops such as bananas in areas where I previously used to heap farmyard manure when I had dairy cattle in the 1980s. My wife has placed her kitchen garden in the compound as it is easy to throw household wastes there. In her Kitchen garden she has planted mainly vegetable crops which require a lot of nutrients. In the upper part of my main farm I have planted cassava, because that place is heavily eroded and is not very fertile. Cassava does not require a very fertile soil.'*

Legumes and root crops are grown on exhausted soils to improve their fertility and quality. Gardens and vegetable plots also receive fairly large quantities of organic fertiliser, much of which has been composted. Sheep and goat droppings are applied to infertile spots in specific fields.

*Swamp development for vegetable production*

Lowland vegetable farming, mainly an activity for women, has become a very prominent activity among all farmers in Siaya. It is an alternative strategy for coping with declining soil fertility in the uplands. Farmers have invested a lot of their resources in developing inland valley swamps (*aora*) in the lowlands so that it could be used for vegetable cultivation. The soils are fertile and can be used continuously, if well maintained. However, valley bottomlands are not freely accessible as they are also privatised. Some farmers who possess such fields and cannot cultivate them themselves will lease them out for free to women's groups.

Farmers use these fertile micro-sites to grow vegetables all year round. However, activities in the valley bottoms reach a peak in the months of

November and December when not much work is being done on the upland fields. Farmers also try to plant their vegetables around this time so that they are ready for consumption in the months of January and February when there is normally serious drought. In valley bottoms vegetables can be irrigated in two ways. If the vegetables are grown on a slope where the stream's watercourse can be diverged, then it is done by furrow irrigation. If the plots are placed slightly uphill, farmers use watering cans to draw water from the stream and water their vegetables by hand. In some valley bottoms, farmers grow arrowroot (*Nduma*). Arrowroots, unlike cassava and sweet potatoes, need a fertile place and lots of water. They are aquatic plants and therefore not drought resistant. The tubers are very rich in energy. They can be harvested at any time of the year and hence are very useful during the famine period.

Abednego Ochieng's farm ends up in a valley bottom, where he has established two fishponds. The fishponds are stocked with a *Tilapia nilotica* strain of fish. He also has some plots planted with cowpeas, kales, Mito (*Crotalaria brevidens*), and other parts of the valley he has allocated to a Muhanda women's group to plant vegetables. According to Abednego Ochieng, the work in the valley bottom is not very easy.

*'Draining the water from the swamp to free-up land for growing vegetables is very labour demanding. You need first to plan how you want to plant your vegetables and then plan for how you will irrigate them. You can then lay out by marking with sticks on the swamp how you want your channels to run. This must be carefully done, taking the slope of the area into account. Then you can dig the furrow channels. The soils in swampy place are sticky and heavy to dig. Most people fear work in the valley bottoms because of the labour involved'.*

#### *Off-farm employment and migration*

Many men in Siaya have responded to the decline in soil fertility and to land fragmentation by abandoning farming altogether. They migrate to seek work in urban areas or in off-farm employment such as trading, or by working for public services or private companies. In the four villages, trade was a very important source of off-farm income for both men and women. The most important activities were shop keeping, working in the hotel industry, fish mongering, dealing in second-hand clothes, and cattle trading. Other trading activities included the retailing of food crops, selling vegetable crops, milling by those owning mills, or making charcoal. In our sample, 38% of the men and 44% of the women interviewed received remittances from off-farm employment. About 40-50% of this income was spent on education, with the remainder being used to buy consumption goods. Only a small part was spent on farm inputs and implements. According to most farmers, such income was not very reliable given the economic situation then current in Kenya.

Women and children remain on the farm and continue to cultivate part of the fields for their subsistence. Those engaged in off-farm employment contribute occasionally to farming activities by material and financial support and by returning to assist with major farming operations. Men will only return to agriculture when it becomes economically viable.

However, while it may provide a source of income, migration also diminishes the pool of available labour and can result in households being unable to muster the manpower required for physically demanding tasks such as building and maintaining soil and water conservation structures, or for producing and transporting organic fertiliser. As farmers rely increasingly on off-farm work for their income, they may have to decide to spend less time on measures needed to improve soil fertility, even though the farm is still important for ensuring food security. Those who are confident that they can buy all the food they want locally, and who feel secure in their new activities, may decide to farm simply as a way of life.

## **Conclusions**

The chapter has highlighted the long-term political commitment to soil and water conservation in Kenya. This has taken a variety of forms, and extension approaches have changed considerably over the last few decades. The colonial authorities were the first to commit themselves to a comprehensive but rather coercive programme of soil and water conservation activities in their quest to maintain agricultural productivity. In the process, subsequent governments have established various departments and commissions dedicated to soil and water conservation. The present government has also joined farmers, donor agencies and NGOs in a nation-wide campaign to restore and conserve soils.

However, the history of soil and water conservation policies highlights several issues relating to the policy process. In the first place, no regulatory policy can succeed unless stakeholders are involved in developing it, acknowledge its legitimacy and support its enforcement. Having identified soil erosion as a problem, British colonial officers then proceeded to formulate a policy to combat it without consulting farmers or telling them why it was important to adopt the measures. This high-handed approach led to the policy being jettisoned after independence, as the coercive manner with which it had been implemented made the farmers resent what were basically sound measures. Inappropriate or unpopular policies are unlikely to survive, no matter how good their intentions. However, in the 1990s farmers began to recognise the need for some kind of action to reduce the damage caused by erosion and started to invest in implementing and managing preventive measures on their own account. This they did by using labour saving measures such as planting of *Tithonia* weeds as internal boundaries to their plots, making



trashlines with crop residues along the contours of their plots to act as barriers against flood erosion, and planting cover crops such as sweet potatoes.

The chapter also outlines how changes in macro-economic policies concerning mineral fertilisers have had an impact on soil fertility management in the entire country. In the 1990s such practices were particularly affected by structural adjustment programmes and associated policies such as devaluation, the liberalisation of crop and input prices, the abolition of subsidies, changes in input delivery and agricultural credit systems, and the downsizing of government services. These policies altered the cost of inputs for most crops and put mineral fertilisers and credit beyond the reach of many farmers who formerly had access. The 'unintended' consequences of many structural adjustment programmes have thus been to reduce the use of mineral fertilisers, marketing support services and credit systems. In addition, the liberalisation policy opened the door to traders who simply adulterate fertilisers in order to maximise profit without caring about the effect of such fertilisers on the soil. Such adulterated fertilisers are a root cause of farmers distancing themselves from them.

Farmers classify soils according to their own local knowledge. They use various indicators to interpret and monitor soil fertility levels and to adjust farm management practices according to soil fertility status of a particular portion of their plot. The criteria farmers use for judging whether soil fertility is declining includes reduced crop yields, change in soil colour, compacting of the soil, and the presence of certain weed species. In response to soil fertility decline, farmers have developed soil fertility management strategies that place parts of their land in fallow for a period of at least six months; that recycle organic matter, and implement crop rotation and crop association. More radical strategies include the development of low-lying, swampy land for growing high value vegetables and other crops, or seeking off farm employment and urban migration to relieve pressure on the land.

Soil fertility management practices have not followed a linear trend towards increasingly intensive farming methods with higher and higher doses of nutrients to the soil, but have followed an uneven pattern, which is particularly evident in the dynamics of mineral fertiliser use. These were initially applied by many farmers, but there has been a shift away from mineral fertilisers towards the use of more labour intensive organic inputs and, although there is little difference in the range of organic amendments used by individual households, there are considerable variations in the quantities used. There is a tendency by farmers to concentrate on using locally available resources as efficiently as possible, although it appears that there are insufficient organic inputs available to sustain soil fertility in the long term.

Even though farmers tend to rely on their own knowledge to try and solve soil fertility problems in Siaya, they are still far from having a sustainable method of maintaining or improving soil fertility. The rate at which nutrients are mined is higher than the diversified strategies used by farmers to restore the nutrients in their fields (cf. Smaling, 1993). Soil fertility decline thus remains an issue in Siaya. Attempts to address the issue will have to take account of the local language of soil classification and fertility monitoring by farmers. The use alone of science-based nomenclature may prevent an effective encounter between scientific and local repositories of knowledge that mediate the relationships between farmers, extension workers and researchers. The next two chapters will deal with this complex process in detail.



## Soil fertility, manure and milk

### Introduction

This chapter deals with how a government and donor-designed project became redesigned by Luo farmers. While the Kenyan government and international donor, the Dutch government, designed and implemented the National Dairy Development Project (NDDP) with a view to increasing milk production for the market, Luo farmers unpacked it to fit their own priority: the reproduction of soil fertility. This phenomenon may explain why the Luo, like other ethnic groups in Kenya, were generally keen on the project. The project therefore produced a series of intended, but at the same time unintended and unforeseen outcomes. The literature provides good examples of why and what kinds of processes explain this (see Crehan and Van Oppen 1988; Mongbo, 1995; Long and Van der Ploeg, 1989, 1994).

Let me begin with a condensed description of what the NDDP is all about. The development of a zero grazing package is central to the project and requires detailed analysis. I will follow this with an analysis of how and why Luo farmers responded to the project. Some farmers redesigned the zero grazing package in order to run their farm the way they liked or were used to, others – and this is important for the argument developed in this chapter – made use of zero grazing in order to accumulate manure to reproduce soil fertility. While the zero grazing package was developed with the Dutch dairy farm and industry as a frame of reference, thus bringing exogenous resources and organisational models, Luo farmers were able to rework these resources to suit their own purposes and priorities. The knowledge needed to redesign the NDDP package and the social networks farmers created to acquire this knowledge will then be discussed. The chapter, in other words, deals with how an exogenous set of resources became endogenous.

### Background of the National Dairy Development Project

One Kenyan government policy in dairy farming is to transform the dairy industry (or sector) through specific technological and organisational improvements in production, marketing, research and extension. The policy is geared to the macro-economically defined perception that the demand for milk – particularly in the 1970's and 1980's and specifically in the urban areas – was far greater than the supply. The consumption of milk in these periods was, more often than not, met by the importation of powdered milk. The national-level

dairy sector policy was therefore designed and implemented to address this situation. The corner stone of the policy is the NDDP, the National Dairy Development Project, financed and technically supported by a bilateral donor agreement with the Dutch government. The NDDP acknowledged the experience from previous programmes (such as a dairy cattle research project (DCRP) carried out at the National Animal Husbandry Research Station (NAHRS) in Naivasha from 1969 to 1976) that there had been very little uptake of research results by farmers. To address this lack of knowledge transfer, MOALD, the Ministry of Agriculture and Livestock Development, submitted a proposal to the Dutch government in 1978 to improve the link between research and extension. In 1979, a project identification and formulation mission gave the go-ahead to the 'Dairy Development Project'. The project's main objective was to meet the nation-wide demand for milk by introducing improved intensive dairy management practices on small holder farms in high potential areas. The specific objectives of the project were to create self-sufficiency in dairy products in the country, provide the population in rural areas with a balanced diet through milk consumption, increase the family income of generally poor smallholder farmers, increase cattle productivity, labour and land, and to increase employment opportunities in the rural areas. Geographical coverage was initially limited to six districts; later it spread to other regions of Kenya. The project started in 1980 and was initially planned to last four years, but subsequent evaluations of its different phases recommended an extension. The NDDP was launched in Siaya district in 1987 under the expansion programme of phase four.

The national extension service of MOALD became the institution responsible for the implementation of the NDDP. It started with the development and introduction of the dairy farm concept *zero grazing*, which involves confining dairy cattle to a stall (a zero grazing unit) and a cut-and-carry fodder system to support a general increase in milk production. The modernisation of the dairy industry in Kenya involved a number of direct and indirect state controlled institutions: Kenya Co-operative Creameries (KCC) for milk processing, the National Animal Husbandry Research Station in Naivasha, the extension services of MOALD, the Dairy Board, and finally various credit agencies (both private and public). In addition, farmer organisations and unions were assigned the important task of providing services (such as milk intake and transport to milk factories) to smallholder dairy producers. Some of these institutions were specifically created, others were revitalised with a 'new mission' - to increase the productivity of land and labour in the dairy sector. Provision of credit and farm record keeping accompanied the package to secure its uptake and to set in place a proper monitoring and evaluation system.

The Dutch government supported the implementation with finance and manpower under long-term bilateral aid agreements that lasted from 1980 to

1999, when its support to MOALD was finally wound up. By that time the NDDP had covered a total of 25 different districts countrywide and over 10,000 farmers were involved in either zero grazing or semi zero grazing dairy farming. Dutch support changed over the years from technical and financial backstopping to assisting the Kenyan government in its privatisation venture within a structural adjustment framework. The major project components privatised over the years were the artificial insemination (AI) and extension services, and the processing and marketing of milk.

### **The zero grazing concept**

Let me begin by examining the implications of a zero grazing programme at the farm level, the level at which most programmes interventions are aimed, and at which policy makers expect their plans to become reality and their aims to be fulfilled within a certain time period. My intention is not to analyse the macro-outcome as such.<sup>1</sup> Nor do I attempt to summate the experiences and transformations of individual farms that constitute the agricultural sector at large, as is frequently done by planners and economists. My intention is simply to describe and analyse what (dairy) farmers do with the technology package and how and by which mechanisms they re-work it to fit their own interests and objectives.

Before embarking on such an analysis I need to describe the zero-grazing package in detail in order to establish the logic that informed its construction. This not only provides a good insight into the package itself and into the prescriptions (or technology codes) of the package, but also into the reasons why farmers were initially keen to become project beneficiaries.

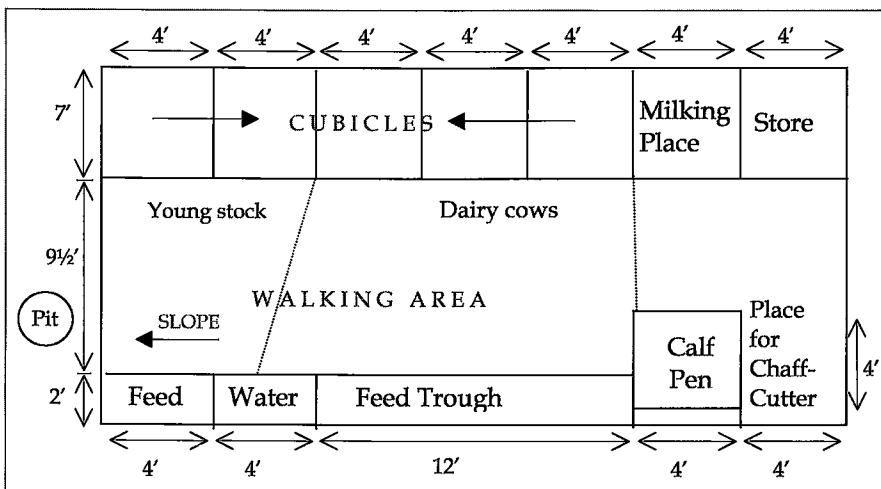
The research component of the NDDP sought to produce a technology package that would address the constraints of smallholder dairy farming. The lack of grazing land, low productivity of the dairy cows, low quality of fodder, prevalent diseases and lack of financial means of farmers were all central elements of the problem analysis (Valk, 1990b, Muma, 1994). The package can best be qualified as a prescriptive type of technology, e.g. a package designed by specialists and outsiders. It consists of various components:

*Housing (the zero-grazing unit):* Figure 7.1 shows the layout of a floor plan of a zero-grazing unit as proposed by the NDDP. A zero-grazing system entails keeping cows all year round inside the zero grazing unit (stable). The unit

---

<sup>1</sup> The results at macro-level can be dealt with quite easily. We only have to refer to the actual increase in the quantity of milk produced for the market, and, to make a superficial assessment of the extent to which the prescribed technology model - the zero grazing package - was internalised.

contains cubicles for the cows to rest, a milking place (parlour), and a calf pen with slatted floor, a concrete walking area for the cows, a feed trough, a water trough, and a mineral box. Besides these there is a store room, a place for chopping fodder, and a small manure (slurry) pit outside the unit in which slurry from the walking area is collected. Apart from the walking area a roof covers the entire unit.



**Figure 7.1. Lay out of the zero-grazing unit floor plan**

An important area of the zero-grazing unit is the walking area. This is between the cubicles and the feed trough. It is supposed to be made of strong concrete with a gentle slope towards the manure pit, which makes it easy to clean. These aspects contribute to hygiene of the animals and reduce hoof injuries. The NDDP recommends that a farmer should own a zero grazing unit before engaging in zero grazing dairy farming. Farmers are required to confine dairy cows to the zero grazing unit in order to prevent tick borne diseases and other health hazards.

*The introduction of improved dairy cattle breeds.* The NDDP recommends that farmers stock their units with graded dairy cows of high milk yield variety. Graded cows are cows with more than 50% exotic or pure bred blood. They are thus not of pure breed. Exotics used for obtaining graded cattle are Jersey, Ayrshire, Guernsey, Friesian and Sahiwal.

*Breeding and fertility:* Farmers are required to maintain the dairy breeds by continuously upgrading their stock through artificial insemination using semen

from a dairy bull when their cows or heifers are on heat. Cows are to be inseminated on the second heat by judging 26 days between the first heat and first insemination.

*The production of high yielding fodder (e.g. napier grass) on the farm itself.* Having a zero grazing system implies that all the animals' feed needs are brought to them as they are not allowed, under normal circumstances, to graze for themselves. The project recommends napier grass as the main feed crop, since its re-growth after cutting is rapid and establishment is relatively easy.

*Utilisation of farmyard manure and artificial fertilisers to maintain soil fertility.* The cut-and-carry system used by NDDP farmers requires that nutrients be returned to the napier plots. The package recommends that farmers return all manure to the napier plot every 2 to 3 days. They are also advised to apply 4 bags (@ 50 kg) of compound NPK fertiliser (20-10-10) per acre per year. The grass is cut daily and, ideally, the manure from the unit is taken to the field at the same time. It is put in a small trench, dug alongside the row just cut. The manure is to be covered and worked into the soil straight away to minimise nitrogen loss through volatilisation caused by sunshine and high temperatures.

*Feeding:* Feeding the dairy cows is the most important activity within the zero-grazing system. Cows are dependent on their owners for feed as they are not usually allowed to graze (except in times of severe fodder shortage). The project advises the farmer to plant 0.75 to 1.00 acre of napier grass per mature cow and its offspring when joining zero grazing dairy farming. Another aspect of napier management is the length of grass at cutting. Trials at Naivasha have shown that the grass should be approximately 60-90cm long before presenting it to the animals. Napier grass is the main fodder crop. Other feeds are concentrates, minerals and crop residues. The quality of feed greatly determines the milk yield of the cow.

*Feeding dairy cows on concentrates and minerals.* Napier grass is not of such quality that reasonable milk production can be achieved with this feed alone. It is quite low in protein content, so the diet requires another protein source. The main source is concentrate supplement, given at milking time, at a rate of 2 kg. per day. Mineral salt lick should be offered to the animals *ad lib* in the mineral box. The reduction of mortality among heifer calves is achieved through improved calf rearing, which includes weaning calves using high protein calf weaner pellets. According to NDDP requirements, farmers are supposed to dispose of bull calves at two weeks old. They estimate that farmers will lose about 400 litres of milk in feeding a bull calf until weaning time. It also consumes



roughage meant for the cows. This measure will ensure maximum profit on the farm.

*Clean milk production:* Clean milk production is an area of emphasis within the NDDP. The zero grazing unit has a special place for milking the cows. It has a concrete floor and a head yoke to restrain the cow during milking. The project advocates the use of clean utensils and proper milking techniques. Farmers are advised to clean the udder before milking, discard the first couple of squirts of milk after having checked it for signs of mastitis (using a strip cup), and to milk evenly and quietly using the full hand method as opposed to striping. Farmers should have a teat dip containing a disinfectant for disinfecting the animal's teats.

*Record keeping by dairy farmers for ease of farm management.* Farmers are recommended to keep records of their activities. Other than helping them to know the performance of their own farms, they are also used by scientists to evaluate and monitor whether the project's innovations are giving satisfactory results. The Dairy Evaluation and Advice Form (DEAF) covers all major management aspects of the dairy enterprise. The form was used by the NDDP extension staff as a tool to improve the quality of their extension work. It guides the extension officer through a detailed evaluation of all the main management aspects of the dairy enterprise. Copies of the form are left with the farmer and with the district office for use during follow-up visits. The DEAF surveys also provides data for the monitoring unit stationed in Naivasha (Valk, 1990b).

Despite the package's varying components, it was presented as a whole to the farmers. This was because the project implementers feared that otherwise farmers would adopt only part of the newly introduced techniques and measures.

The NDDP's activities can be summarised as extension and training activities within the MOALD. The extension activities were developed over several years, beginning with an inventory of the constraints hindering small-scale dairy development. The project then developed an extension strategy as follows: the creation of awareness during specific extension activities, technical assistance to farmers through individual farm visits, preparation of a farm liquidity budget form, further technical assistance during a 'recruitment' phase, farmer training during courses, workshops, field days and follow-up visits after registration.

The educational aspect was considered the most important element in the programme. Apart from the regular extension education, the strategy focused on organising training courses at Farmers Training Centres and arranging field days. Contact farmers were expected to show neighbouring farmers the effects

of the change on their farms. It was assumed that farmers would accept the experience of the demonstration farms and accept these as valid for their own conditions.

The institutional strengthening and training activities of the programme supported the extension service, since the programme provided funds for staff training as well as for local travel, thus ensuring mobility for the extension staff.

### **Dairy farming and zero grazing in Siaya**

Dairy production from grade cows has been developed in Kenya over half a century in two distinct phases, first on large-scale European farms during the colonial period, and increasingly since the 1950s on African smallholdings. British colonial administration divided Kenya's agricultural lands into so-called 'scheduled' and 'non-scheduled' areas (Stotz, 1979: 1). The scheduled areas were allocated to European settlers for large-scale farming and the non-scheduled areas were for small-scale dairy farming. Thus, a rural economy was deliberately established on dualistic lines, and one of the expectations of this policy was that the European farmers, with the financial and technical support of the government, would be the effective innovators. This dualistic pattern brought with it a host of social, economic, cultural and political problems, but the European farmers did introduce a number of innovations, including grade cattle and the establishment of a commercial dairy industry.

Livestock rearing in non-scheduled areas was left mainly for indigenous types of cattle. Livestock farming systems in these areas were of two types: - migratory herding and non-migratory or sedentary herding. The latter was commonly practised in Siaya during the colonial period. Grade cattle were not to be kept in these areas because people lacked the management practices required. Prevalent diseases were also high in non-scheduled areas. Dairy cattle made their way into non-scheduled areas via African farmers who had learned modern dairying techniques while working on European farms. This was later enhanced by the Swynnerton plan drawn up in 1954 to accelerate agricultural development on the African smallholdings (*ibid.*: 6).

During the colonial period, milk production from the large-farms was for urban consumption and export. Little of it reached consumers in subsistence-oriented smallholder areas. However, demand for milk in these areas was increasing due to the growing population and an increase in purchasing power from wages earned on European farms and elsewhere. Rapid population growth had also led to the reduction of grazing land, and communal pastures were often overgrazed and unproductive. This situation led to high milk prices in some of the more densely populated areas. African farmers, who had learned modern dairying techniques on the European farms and who had accumulated savings, therefore began to buy grade cows for their own farms (Cowen, 1975:

10). They were encouraged by the availability of grade heifers on neighbouring large farms at relatively low prices. This way these animals found their way onto the smallholder dairy farms including small farms in Siaya district. The first batch to set foot in Siaya, were introduced in 1953. When official support was finally given to their introduction, in 1955, farmers had to meet very stringent conditions. First, they had to own a stir-up foot pump for spraying the cattle against ticks (Heyer, 1975: 157, Lavrijsen, 1984: 42). They had to fence the farm and divide it into paddocks using barbed wire fencing. The European veterinary officers stationed at Maseno helped Siaya farmers by running vaccination programmes, extending and supplying information on livestock diseases, treating sick animals and promoting dipping and spraying against ticks to stop the spread of tick borne diseases. According to Patrick Odongo, a farmer in Muhanda village, some 10 farmers had grade animals in the district by 1957. He first saw the exotic dairy cattle on Maseno veterinary farm when he was a student at Maseno High School. Between 1951 and 1952 he trained in general livestock management in Thogoto College (now a teachers training College) in Central Province. He was then posted to a primary school back home in Siaya to teach general science. It is in this college that he developed an interest in dairy cattle. In 1953 he bought his first exotic dairy cow. The breed was a Sahiwal, originating from Pakistan. In 1963 he bought two more dairy cows, this time an Ayrshire breed and he has gone on from there. He has faced ups and downs with these animals, but has managed to keep them to date. He claims he was the first to keep exotic dairy cattle in Siaya. Other farmers did not join him because of the problems they saw him face.

*'Luo society has been negative about these animals. They see failure even before starting. They lack motivation. There are also other reasons behind it. The memories of sugar, cotton and coffee failures are still fresh in people's minds. We have been terribly disappointed with the marketing institutions that were charged with marketing farmers produce through co-operatives. These institutions literally failed to support the farmers who then had to uproot their crops. Since then, people have been cautious in taking up new technology from outside. Secondly, Luos were originally pastoralists, and have a strong attachment to the local breed of cattle. They were cattle cultured. People had over 40 heads of cattle in earlier times. It was a question of prestige. The sentimental attachment is due to the functions of the animal in the society. The old custom of taking cattle to the people of your wife as bride wealth still exists and even if you pay money as bride wealth, you will still have to take cattle. We are in a transition period where you cannot divorce the past and jump into the present. I have to pay bride price for my son in order for him to have a wife. If the society can accept money and stop thinking of cattle as bride wealth, then we can do without local cattle. During funeral ceremonies, you have seen the bulls being slaughtered to take care of the visitors in a home. If you have an emergency, you quickly can sell off cattle to solve it. These functions cannot be performed with the graded dairy cattle, given their cost'.*

When Patrick Odongo started dairy farming, he first practised tethering and then the paddocking system. He further mentions that the number of African zebu cattle are shrinking so fast that Siaya people have to think of alternatives. When the NDDP project was launched in Siaya in 1987, under the expansion programme of phase four, farmers were actively seeking alternatives to alleviate the problems caused by reduced land sizes, low incomes, loss of soil fertility, and market failures for cash crops like coffee, cotton and sugar. Some innovative farmers had already started zero grazing after seeing its benefits in neighbouring districts like Kakamega and Vihiga districts. Apart from the high milk yields produced, farmers were attracted most by the high amounts of manure that accumulated in the zero grazing unit. They saw this as a way of improving the nutrient status of their soils and restoring the waning livestock-crop interaction.

Odongo got the information to shift to zero grazing dairy farming from friends in Kakamega district who were already practising it. Though he had first been introduced to zero-grazing in 1969, on the Maseno veterinary farm, in 1980 when the NDDP started up in Kakamega district, he was able in 1983, through his network of friends in Kakamega, to convince the NDDP extension staff to design him a zero grazing unit for his own farm. He stocked his unit with two of his own dairy cows, which were on milk. The rest remained in the paddock.

*'When I took the animals into the unit, their milk yield shot up and I had also a lot of manure. However, the labour requirement increased. The workload in the unit is heavy. By 1984, livestock extension staff had started to use my farm as a demonstration farm. When the NDDP was launched in Siaya in 1987, there were already ten farmers practising zero-grazing dairy farming in the district'.*

Selina Okeyo first saw exotic dairy cattle in the Rift valley and Central Provinces where her husband was an education officer. However, the information to start zero grazing came from her eldest daughter, far earlier than the launching of the project in Siaya District. In the Rift valley, she saw graded dairy cattle on Lord Delamere and Lord Egerton's farms.

*'In 1979, my husband bought land in Rongai in the Rift valley and set up a dairy farm. He practised a paddocking system, where the cattle are left to graze in fenced paddocks on a rotational basis. In 1983 when I came to live at home, my eldest daughter was working with the Kenya-Finland Livestock Development Programme in Kakamega district. During the same period the NDDP was launched in the area and my daughter invited me to attend some seminars on zero grazing which she was organising. She knew I was interested in dairy farming. In particular I was in need of the manure that accumulates from the zero grazing unit. My plots lay in a sloppy area and due to soil erosion they were no longer fertile. After attending the three seminars she organised in Kakamega district, I was inspired to join the zero grazing enterprise. I started zero grazing in 1984 before the NDDP was launched in Siaya*

*District. I was introduced to Patrick Odongo through a friend and from him I bought a Guernsey dairy cow with money from my own savings'.*

Selina never wanted to get a dairy animal from her husband's farm in Rongai. She preferred to be independent. Her husband was very positive about her project and encouraged her. Given that there was no NDDP extension agent in Siaya, her daughter designed the zero grazing unit for her.

The project started in Siaya district with ten demonstration farmers. Gradually more farmers joined the project. Farmers were recruited to the project by several means. Neighbours of farmers already registered with the NDDP saw the zero-grazing system functioning and as a result became interested and asked the neighbour to help them join the project. Before joining, the livestock technical assistant and the interested farmer would calculate whether the farm was suitable. If their calculations were positive, the farmer could start planting napier grass and building the zero-grazing unit. He is at this stage considered recruited. Once the fodder is planted and the unit is finished and stocked the farmer becomes a registered farmer. The NDDP worked closely with registered farmers only, e.g. those not only willing to engage in dairy farming, but who also complied with the criteria above.

### **Zero grazing in practice**

I now look in detail at the activities of farmers and their redesigning practices. In the earlier sections I described how smallholders responded to the NDDP in a particular way: zero grazing was internalised but as the technical changes were implemented, a number of constraints emerged that gave rise to redesigning the package. Redesigning is here treated from two perspectives: First *technically*: Farmers changed the codes of the package by developing alternatives and adapting the original layout. Second *socio-culturally*: redesigning took place against the background of their livelihood strategies. Farmers redesigned because the zero grazing package did not completely fit in with the way they perceived farming, socially, economically and culturally.

#### *Farmers' redesigning practices*

By the time of my field research, the majority of the registered farmers in Siaya district had partially or completely redesigned the zero grazing package. Those farmers who had completely redesigned the zero grazing package were no longer considered zero grazing dairy farmers but were labelled *dormant* farmers. The redesigning of the zero-grazing package was necessitated by a number of constraints that made them unable to fit the zero grazing package with their farming practices. They redesigned the NDDP package to suit their economic and social environment. There is indeed a large variation between farmers in Siaya district as far as the adoption of each and every component of the NDDP package

is concerned. Below I present the results of the baseline survey as well as the in depth case studies carried out on farmers redesigning zero grazing practices. Note that the data were collected during and after the project period.

#### *Housing (the zero-grazing unit)*

Most dairy farmers in Siaya district have a zero-grazing unit. On average each unit has four cubicles. Of the 30 farms visited, eighteen had units without calf pens. The farmers prefer to keep calves in a separate stall where a fire can be lit to keep them warm at night. This provides them with hygienic conditions and protects them from adverse environmental conditions. The majority of the remaining 11 farms had a calf pen with a slatted floor, essential for keeping the calf off the ground. The calf therefore does not then come into contact with its own faeces and the pen is easily disinfected. Others had calf pens without raised floors but used bedding instead on the floor for the calf to sleep on.

Of the farms visited about 30% had walking areas below the requirements of the NDDP package. This represents a considerable proportion of units with poorly constructed walking areas or old worn out and unrepaired floors. Most farmers therefore opted to keep their animals outside the unit. They do not bother to repair the walking area because of the cost and labour involved. About 17.6% of the units in Siaya district have no slurry pit. Instead, where the topography allows, the farmers allow the slurry to flow into the napier field by gravity. Some farmers just remove the dung manually from the unit and heap it somewhere to decompose to form farmyard manure.

Joseph Ogwanjo, a dairy farmer from Nyamnina village, does not return slurry to the napier field as recommended by the NDDP. In his words:

*'Since I designed the zero-grazing unit myself, I excluded the slurry pit. Instead I dug furrows from the unit to my plots down the slope. This way, slurry can flow to my plots with ease thus reducing the labour that would be required to ferry them there. Right from the beginning, I foresaw that the labour required in returning the slurry back to the field was going to be high and intensive. That is why I had to alter the design of the unit to suit my own conditions'.*

Kotoyo a farmer from Muhanda village also has no slurry pit in his unit. Born in 1951, he is married to one wife and they have five children. He is a primary school teacher and his wife supervises the farm work. They are rearing their dairy cows in a unit, which again is not designed to the NDDP standards.

*'Since I did not have sufficient money at the time of its construction, I did not install some of the components. I did not fit in the calf pen; instead I keep the calves in a room which used to be a feed store for poultry. I did not include the slurry pit and in my unit I use bedding of maize stover and grass for my livestock in the general sleeping yard. The bedding absorbs urine and dung, which I compost into manure. Sometimes I sell the manure to other farmers at KSh. 1 300.00 per tonne. I feed my animals outside the unit during daytime'.*

He gave the following reasons for keeping his animals outside during the day.

*'Since I made my unit in a different way right from the beginning, I do not see any reason for keeping the animals completely in the unit. Secondly, I made transportable feed troughs and a drinking trough which I can easily take outside the unit. When the animals are outside, they get a chance to walk around and exercise'.*

Yiengo Rateng is practising extensive grazing of grade dairy cattle along the riverbank contrary to the recommended convention. He told me that he made these changes in order to save on labour, which was a real problem on his farm. Apart from saving on labour, he claims that an animal raised outside the unit exercises and has high resistance to diseases. They do not have calving problems. Mr. Odongo, who he mentioned as having been farming since the 1950's, gave him this knowledge. He also advised him to follow strict routine management like spraying against ticks twice a week and de-worming once every three months.

Patrick Odongo practises various methods of rearing grade cattle because he was already raising such cattle before zero grazing was launched in Siaya and therefore has had a chance to experiment with various methods of rearing dairy animals. From tethering to paddocking, to semi-zero grazing to zero grazing. That is why they are all found on his farm. He insists that it is good for the animals to be walking outside the unit and feeding on natural grass.

*'From experience I know that when you keep cows throughout in the unit, they are bound to have calving problems. The cow has to be helped during labour and the placenta in most cases is nearly retained. This is not the case with semi-zero grazing. The animals exercise and hence do not experience problems with calving. I did this experiment with one of my old cows. Animals in the unit have lower disease resistance than animals kept under semi-zero grazing. However, animals kept in zero grazing units give more milk and a lot of manure can be collected from the unit'.*

#### *The introduction of improved dairy cattle breeds*

Most zero grazing farmers in Siaya have graded cows in their units, that is, cows with more than 50% pure bred blood. There is a problem in Siaya to obtain graded cattle. The main suppliers of graded dairy cattle are the MOALD extension staff and the CPK-Diocese of Maseno West. They go scouting for the animals on behalf of farmers in Nandi and Kericho districts. Since the initial capital for acquiring such animals is high and the animals are not readily available, after acquiring the animals farmers tend to cross them further with the African indigenous zebu. Alternatively farmers with African zebu cows use artificial insemination with the semen of an exotic dairy bull after the first calving of the cow. If they are lucky to get a heifer, they are convinced that she might give a lot of milk when it calves.

After her cow's first calving, Pamela, the wife of Oluoch Agulu (case 3, chapter 3), used AI on her cow with semen from an Ayrshire and got a heifer calf on second calving that was thus a crossbreed. Since then she has been using a dairy bull to serve her cows. At the time of the research she had constructed

her zero grazing unit and stocked it with three of her own cows cross breed in this way.

However, Oduor Lomo has been quite unlucky. He has been using AI on his African zebu cow, but after three crossings has produced only bull calves.

*'I hope one day I will succeed in getting a heifer. I really need an exotic dairy animal as my elder daughter is about to go to secondary school and sales from milk can help me offset her school fees'.*

#### *Artificial insemination services*

AI services in the research area face many problems. In Yala division, there is only one AI service agent and he is without motor transport. He covers long distances on a bicycle and when it rains he must either walk or simply not attend the farmers. Shortage of funds for the operation and maintenance of the only vehicle allocated to the department adds a constraint to AI services. Lack of a deep freezer for storing liquid nitrogen semen means the ministry must supply room temperature semen that lasts only three days. Thus farmers have to seek AI services from private organisations in the neighbouring district, Vihiga, and Maseno. In the year 2000, the Yala Dairy Co-operative society managed to acquire liquid nitrogen semen. However, they still had problems getting qualified staff. They had to hire staff from the MOALD, Yala Division. Farmers who cannot afford transport to these centres resort to the use of a stud bull. This is what Yiengo Rateng does,

*'I dropped the use of AI services because they are unreliable. Furthermore, I learnt from Mr. Odongo that sometimes cows show silent heat signs that farmers can't detect but the bulls can. This is why I have opted to keep the stud bull that was on my farm. He relied on veterinary services and AI, but their services are declining every year'.*

Like Yiengo Rateng, almost every farmer with dairy cattle tries to keep a stud bull to serve the cows because the AI services are not reliable.

#### *Fertility*

Closely related to AI are the rather poor fertility results of dairy cows in Siaya. The main constraints to good results are poor heat detection by the farmers. The heat period is shorter in hot humid conditions than in temperate conditions. Silent heat occurs due to high temperatures and under-nutrition (especially of minerals) has an effect on fertility. This is especially a problem in the dry season.

The period between calving and first heat detection is long. Part of this may be due to climatic conditions resulting in a longer oestrus period but the main reason is that most new zero grazing dairy farmers have difficulty telling when a cow is on heat. Cows are inseminated on the second heat judging by the 26 days between the first heat and first insemination. To reduce the problems of



infertility farmers have responded by keeping stud bulls. According to Leegwater *et al.* (1990) the reason for this is often that the farmers find the AI services irregular and complain of obtaining moderate results leading to longer calving intervals. In order to shorten calving intervals farmers resort to the use of a bull if the AI service does not show up on time. The negative consequences are that bulls with a lower genetic potential for milk production are used and the risks of the spread of venereal diseases are increased. However, considering that the cow will be in calf sooner and that the genetic potential is not the foremost limiting factor for milk production in the area, the practice may be justified.

Kotoyo let his cows to be served by artificial insemination at any first heats (including the first heat 21 days after calving) contrary to a recommendation to service AI on the second heat when the first heat occurs within 21 days after calving.

Even though Kotoyo is aware of the correct time to administer AI, he does not honour it. This is due to his experience with the AI services in the region. AI services in Siaya are quite unreliable and farmers have a feeling that they should always take immediate action once the animal shows heat signs. Secondly, sometimes the animal shows silent heat signs through out the heat period without Kotoyo detecting. *'That is why we prefer that the animal be served once it shows the heat signs'*.

With regard to sick animals, some farmers do not use the veterinary staff stationed at Yala divisional animal health department but use herbs instead. Pamela Oluoch relies only partly on the veterinary services to treat her livestock and to control internal and external parasites, and also uses herbs. She is convinced that herbs have proved efficacious with the local cattle breed and that it can prove the same with graded dairy cattle. *'During calving, when the placenta is retained I use a concoction of pounded cassava and its peels mixed with Sesbania roots and other herbs to help the animal'*. Her mother passed down this knowledge of herbs to her. Her husband, Oluoch Agulu, does not know the other herbs she uses. She does not give out the names of the other herbs that are those believed to contain the active ingredients that release the placenta. Pamela told me that she will only pass this knowledge to her daughter and not to her son. Pamela has an obligation to protect her medicine from being patented. This is the custom. Pamela is convinced that there is no need to go for expensive veterinary services after proving the efficacy of the herb from experience since childhood.

#### *The production of high yielding fodder (e.g. napier grass) on the farm itself*

The redesigning of the technology packages was treated by the NDDP as problematic though they recognised that it was happening. It commissioned in

1989 consultancy research to enquire into the diffused elements of the zero grazing system. A major redesigned component is that farmers rarely meet the standard recommendation of one acre (0.4 ha.) napier per cow and follower. The NDDP saw this as a challenge to the sustainability of the smallholder zero grazing practice. The project responded by introducing multi-purpose fodder trees to bridge the protein gap. The impact of this has not been assessed systematically yet, but doubtless it is marginal (cf. Muma 1994: 12).

Most zero grazing dairy farmers have on average two to three cows and one or two heifers and there is usually one calf (male or female). One out of every 10 farmers has a fully-grown bull on the farm and about half the farmers have a young bull. Herd development consists of increase through birth and buying and decrease through mortality and sale. Most farmers have not succeeded in stabilising herd size to acreage of fodder.

The project advises the farmer to plant 0.75 to 1.00 acre of napier grass per mature cow and her offspring. From the farmers I interviewed the majority of them had between 0.4-0.6 acres of napier per cow and her offspring. Farmers do not find this a problem as they always supplement napier with other roughage or alternatively buy napier from neighbours who have no animals. Another aspect of napier management is the length of the cut grass fed to cows. Trials at Naivasha have shown that the grass is best cut when it is approximately 60-90cm long. Sixteen per cent of the farmers cut the grass at less than 60cm, 70% cut it when it is 60-120cm and 12% cut it when it is higher than 120cm (cf. NDDP-DEAF survey 1994). The cutting regime is determined by the season. During the season of plenty it is cut at a higher height and during the dry season farmers cut it at a lower height. The majority of the farmers supplement napier grass with crop residues such as maize stover, sweet potato vines, banana leaves and stems, and molasses.

Kotoyo cuts napier grass at any height for his animals, contrary to the NDDP recommendation of 60-90 cm. He told me that seasonality forces him to do this.

*'During the time of scarcity I am forced to also feed the African zebu cattle on napier grass. This lowers the amount of napier for the dairy cows. So then I harvest the napier below 60 cm. During the time of plenty (wet seasons) the napier grass can overgrow, simply because during this time a lot of labour is needed in other areas of the farm. So then I only cut napier for the dairy animals and not for the African zebu. The herds' boy looks after the zebras outside the compound and there is enough herbage for them. There is at this time also too much napier grass for the dairy animals and so it overgrows and is cut at a height above 90 cm'.*

Kotoyo feeds maize stover in the months of July-August and in the months of November-December as roughage. Feeding maize stover instead of napier grass is something he has known since childhood. However, if he feeds maize stover instead of napier grass then he told me he has to supplement feeding with slightly more concentrates.

One farmer, however, maintains five dairy cattle in his zero grazing enterprise with no acreage of napier grass. Mr. Ayungo Obongita is a civil servant in the Ministry of Water. He is 48 years old and married with three children. He came to Yala in 1979 to work as a technician on the Sidindi-Malanga water project, when the Kenya government started a piped water project to supply the whole of Northern Siaya and the Southern parts of neighbouring Kakamega district. Though a Luo, he comes from South Nyanza district and is not a native of Siaya.

In 1990, he had saved enough money to buy a plot in Yala town with the intention of constructing a rental house. However, he lacked the funds to do this and decided instead to subsistence farm on it. He grew maize and beans on the plot but the yield was too low because the land was highly degraded due to massive soil erosion. During this time he bought his milk from a Kikuyu friend, a Mr. Njagi, who was working with CARE-Kenya as an extension agent and had also bought a plot in Yala town. He constructed a zero grazing unit on it and stocked it with two cows.

Obongita does not have the land to grow napier grass and thus relies on wild napier grass cut from the riverbank and roadside grass.

*'Before starting zero grazing I saw how my friend Mr. Njagi fed his cows. Like me he has no land to plant napier grass. He told me exactly how he went about it and gave me encouragement to join the enterprise. He also just relies on the wild riverbank napier, roadside grass and banana stems. I am doing the same and the experience of some years now shows that I can manage. In most cases I buy napier grass from farmers who planted it but failed to secure dairy cows'.*

They both buy napier grass from farmers and in times of scarcity they buy banana stems to supplement their roughage requirements. Sometimes he exchanges manure for napier grass, a wheelbarrow of manure for four bundles of napier or maize stover. Most of the roughage such as napier, banana stems, sweet potato vines and maize stover comes from farmers living around the periphery of his farm. He buys concentrates from farm stockists in Yala town or in Luanda town in Vihiga district.

#### *Feeding of dairy cows on concentrates and minerals*

Reasonable milk production cannot be achieved when feeding solely napier grass. It is quite low in protein and this must be supplemented from another protein source. This comes mainly from a concentrate supplement given at milking time. Most farmers use commercially available dairy meal – given at a rate of 2 kg per day. Though some farmers give dairy meal below this rate due to having ample roughage, Siaya is still considered as average when it comes to the level of supplementation. Some farmers in the district have managed to

develop a "home mix" dairy meal. Kotoyo is one such farmer. The idea came from his children who had learnt of it in school.

*'They got this knowledge from school during their agriculture class. During class discussion, one of the pupils talked about it and they picked it up from there. When we tried it, we found it worked. We then calculated the cost of using home mix dairy meal and came to the conclusion that it is cheaper to use than commercial dairy meal. Furthermore the milk produced has a higher butter fat content compared to milk produced from an animal fed on commercial dairy meal. Our children gave us this ratio to use when making home mix dairy meal. For a 100 kgs bag, we require 40-kg sunflower cake, 40-kg maize grain, and 10-kg sorghum, 5-kg Soya beans and 5-kg dried cassava chips. We then dry the mixture and mill. From my estimate it costs KShs 500.00 to make this mixture while a 70-kg bag of dairy meal costs KSh. 750.00 excluding transportation. I feed 2-kg of home mix dairy meal per lactating animal daily just like for commercial dairy meal. However, when I feed home mix meal I get almost twice as much milk as I would from commercial dairy meal. Furthermore the butter fat content of the milk is high. This you can just see at the time of milking. The milk appears more yellow than when you feed commercial dairy meal'.*

Some farmers have embarked on using brewers waste (*machicha*) as protein supplement. They get this from Kenya Breweries Limited in Kisumu District. They find brewer's waste cheap to buy even though its transportation from Kisumu is costly. Some farmers interviewed told me that when they use brewers waste, milk production goes up by 7 litres a day. The waste is fed to the animals *ad lib*. One farmer with much experience of brewer's waste told me that when he stopped feeding brewers waste, the milk yield dropped tremendously and the cow did not respond even when fed dairy meal. He had to revert back to feeding brewers waste.

Ogwanjo is one of the farmers who uses *machicha* to feed his dairy cattle. He does not feed lactating cows on dairy meal as recommended by the NDDP.

*'Feeding brewers waste is cheaper than feeding dairy meal. I used not to buy dairy meal when the Kenya Breweries plant in Kisumu was still operating. 1998, when the plant stopped operating, is when I started buying dairy meal. Machicha was always available in plenty and I supplemented it with napier grass even during the dry period. The animals were so used to feeding on machicha that when I shifted to dairy meal, they found it difficult to do without it. The amount of milk dropped drastically. To maintain the level of milk production, I have decided to start buying machicha locally from brewers who make traditional alcohol (busaa)'.*

Ogwanjo uses his farm records to compare the cost of dairy meal with feeding brewers waste (*machicha*). Dairy meal costs KShs 800.00 per 70 kgs bag while *machicha* costs KShs 400.00 per 1.2 tonnes.

*'With this 1.2 tonnes of machicha I can feed 6 cows on milk for six weeks, but with 70 kg of dairy meal I can feed 6 cows on milk for only 1 week. I don't just feed machicha during milking, but the animals generally get free access to it. I also do not weigh it'.*

The innovation of using *machicha* instead of dairy meal was his second wife's idea. He states that his wife knew of *machicha* use much earlier from her

paternal uncle who fostered her after the death of her parents. She used to see her uncle buy this feedstuff from the Kenya Breweries Kisumu Plant<sup>2</sup>.

Additional sources of protein are the fodder legumes. Some farmers grow napier grass mixed with the fodder legume *Desmodium spp.*, which apart from increasing the protein content of the cattle feed, also fixes nitrogen in the soil. Fodder trees like *Leucaena spp.*, *Calliandra spp.*, and *Sesbania spp.* are also used to increase the protein content of the diet. Yiengo Rateng stopped using dairy meal and started to use leuceana and calliandra fodder trees for this reason. There are several leuceana and calliandra trees on his farm, established by him with the help of ICRAF and CARE-Kenya agro-forestry extension agents. He claims that when he increased feeding fodder trees, he got the same amount of milk as he had from dairy meal. He has also planted a lot of napier grass and has an excess of it. He claims that milk production has thus increased on his farm.

To 'dry' his cows, Patrick Odongo uses poor pasture grass. He learnt this technique during in his training and it was reinforced by his own farming experience. "*When I graze the animals in poor pasture or in an over grazed paddock, the cows milk dries off very fast.*" In the second month of drying he leaves the cows to graze in a paddock rich in grass legume mixture. He planted *Desmodium* in his paddocks to improve his pasture, obtaining the seeds from a veterinary officer friend in Maseno.

Another aspect of feeding management that has been redesigned by some farmers has to do with the feeding of calves. Mr. Ayungo Obongita feeds his calves on powdered milk mixed with warm water and is thus able to sell all the cow's milk. He discovered that it works through trial and error.

*'By accident, I bought four cartons of powdered milk for my shop that had passed their expiry date. When I discovered this, I went back to the wholesaler to demand my money back. I did not succeed, so instead of throwing the cartons of milk away, which would have meant a big loss, I decided to experiment with it on my calves. I stopped feeding the calves on whole milk for a week and fed them powdered milk mixed with warm water instead. For the whole week there was no change in the animals' behaviour. When I calculated, I found it was cheaper to feed the calves on powdered milk than on the milk from their mother. From there on, I have been feeding them on powdered milk as I make profit on whole milk. It takes only 15 weeks and then the calves are weaned'.*

Ogwanjo has also redesigned how he feeds his calves. Instead of weaning them using calf weaner pellets, he prefers to use dairy meal.

*'After experimenting with the calves on my own farm, I found that dairy meal can serve a similar purpose to calf weaner pellets, and the calves like dairy meal most. The calves also like sweet potato vines. I found that using dairy meal and sweet potato vines to wean the calves is*

---

<sup>2</sup> The Kenya brewery plant in Kisumu closed down in 1998 due to stiff competition from the South African brewery plant established in Thika.

*far cheaper than buying calf weaner pellets. The calves start getting a handful of dairy meal at two weeks and this continues to increase gradually up to three months when they are completely weaned'.*

Another aspect of calf rearing redesigned by Ogwanjo is the rearing of bull calves for more than two weeks, contrary to the NDDP advise. In his experience, however, nobody has been willing to buy the calves at two weeks because they are just too young.

*'Taking care of them is not easy there after and they can't be sold for slaughter either at that age. Furthermore the bull does not require special feeding once weaned. They can be fed on low quality pasture and the remaining feed from the feed troughs of the cows and heifers. This also reduces the wastage of feed. To increase the palatability of the feed, I sprinkle molasses on the feed. Secondly, it is against Luo custom to dispose of a two-week-old calf so nobody will buy it and they cannot eat it either. Any sort of mistreatment of a calf can lead to being branded a witch'.*

Selina Okeyo is also of the same opinion:

*'I find it difficult to dispose of two-week old bulls, as nobody will buy them. There is nowhere I can take a two weeks old bull calf. And in any case I need these bulls to solve the problem of the unreliable AI services in the region'.*

#### *Utilisation of Farm Yard Manure and artificial fertilisers to maintain soil fertility*

The majority of farmers in Siaya (92%) do not apply fertiliser to their napier. Those who do, apply on average 39kg/acre/growing season instead of the recommended 100kg. Figures on the amount of manure returned to the napier plots in Siaya is not that positive either. Only 35% of the farmers are returning all or most of the manure to the field while 19% return approximately half and 46% return little or none (cf. Van der Valk 1990b). There are several reasons why the farmers do not apply fertiliser. Most of those interviewed, cited that a bag of fertiliser is quite an investment and they would rather use it on food or cash crops, especially commercial vegetables, rather than on napier grass. Another big drawback is that fertilisers are not readily available everywhere in the district. In practice, much less manure may be returned to napier on vegetable and banana growing farms. Another reason could be the result of changes made by farmers to their zero-grazing units, resulting in an inadequate collection of the manure, making it difficult to get it to the field and it is thus wasted.

The farmers interviewed ranked napier grass as the preferred forage for their livestock. However, they identified the high labour requirements for weeding, the high fertiliser requirement, its low productivity after 3-4 years of production and its poor growth in the dry season, as the major problems of napier production. The napier on some farmers' plots were infected with rust or fungal like diseases.

With sufficient manure from his unit, Yiengo Rateng has been able to expand his farming to growing high value crops such as vegetables (Kale, cabbage and onions). He is the main supplier of vegetables to the secondary schools in Yala Division. Villagers also buy vegetables from him. He complains that despite the lack of employment in town, young people still move there and do not want to work on the farms. There are a lot of jobs in the village, yet young men do not take them up.

*'The work involved in the dairy enterprise is hard. Young men fear it. Secondly there is a secret when it comes to labour supply. Young people in this village do not want to work for us. There is general discrimination around. If you come from a family that were slaves to the dominating clan long ago, the children of the dominating clan might not want to work for you. They feel it is degrading to work for their servants. It is associated with failure, and it is a shame they must hide. Even if you have wealth, you can only get labour from somewhere else'.*

Kotoyo's wife reckons that as much as she appreciates the value of the zero grazing enterprise, it has added heavily to her workload.

*'Since we started zero grazing, the milk has always been available for family consumption. This has improved the health of members of my family. My financial status has also improved. I pay school fees for my first daughter in a residential secondary school with the money from milk sales. The enterprise has created self-employment for me and I am not regarded as a housewife any more. Manure for improving the fertility of our land has also increased and we no longer go for artificial fertiliser. However the zero grazing enterprise has increased my responsibilities. I now have a double workload. I no longer have any leisure time nor do I have time for my friends'.*

On one acre of his farm, Oluoch Agulu is raising napier grass using a new method known as *tumbukisa*. It is an innovation by the farmers themselves in response to the high labour demands of the usual method recommended by the NDDP. The usual way of planting napier grass is a recommended spacing of three feet by two feet. His wife, Pamela, learnt of the new method at a Risasi farmers self help group meeting. She was then invited by some friends from Vihiga to go see how they were doing it.

*'In this method, I only have to dig a hole three feet by three feet and four feet deep, mix the top soil with three wheelbarrows of compost manure from the dairy unit and use the mixture to refill the hole. I then plant about ten cane sets on top of the filled hole in a concentric manner. This way, I only have to top dress with slurry once after every six months. This reduces the labour intensity of applying slurry twice a week. Since the holes are placed two feet from each other, I also plant sweet potato in between. This way, I benefit from the tubers, which we eat in the family and the sweet potato vines I feed to cattle'.*

Since *tumbukisa* is a very effective way of utilising manure, and with the continued rise of fertiliser prices over a number of years, Oluoch Agulu has stopped using fertiliser on his plots. His judgement that manure generated from the unit would substitute fertiliser was based on earlier experiments he had conducted with farmyard manure from the African zebu cattle pen and from his experience of

having used manure as a soil improvement medium since his childhood. Apart from his own convictions, he was given similar advice by a technical officer from the crops department.

The NDDP package recommends that slurry should be taken to the napier field every two or three days. Mr. Odongo does not follow this advice but takes slurry to the napier field once every two weeks.

*'Returning slurry to the napier field is labour intensive and demanding. Secondly napier grass is for me a secondary crop that I do not need to give a lot of manure. I cannot eat on napier grass. I need manure for my food and horticulture plots. When the extension agent from the crops department comes here, he always encourages me to use slurry on my horticulture plot and compost manure for growing food crops. I have benefited from his advice. I get a lot of money from the horticultural plot. The money is almost equivalent to what I get from milk sales. I need the manure to improve the soil fertility of my degraded farm'.*

Obongita dropped the use of a slurry pit in the unit and instead constructed a furrow that takes the slurry by gravity from the unit into a flood channel outside the plot.

*'Since I do not have a napier plot to take the slurry, initially I had to use a bucket to remove the slurry from the pit to pour it into the flood channel. I found this work quite tasking. When I visited Mr. Ogwanjo in Nyamnina village, I found him taking slurry back to the field by gravity flow. He showed me how he had designed his furrow channels. That is where I got the knowledge to change my way of disposing of slurry'.*

Other farmers like Yiengo Rateng and Selina Okeyo, whose plots extend up to the stream, have fishponds. They use cattle dung from the unit to fertilise the pond. Another important function of cattle dung in the society is for women to mix it with clay soil to plaster the walls and floors of their houses. This competes with the amount returned to the fields as manure. Over 90% of the homesteads in the four villages have traditional mud-walled houses. Homesteads without cattle must go begging from those with cattle. According to Luo culture, dung should be offered free, but times are changing and there are those who now refuse to allow dung to be collected from their cattle pen.

#### *Clean milk production*

Correct milking is still a problem in Siaya district, which is evident from the high occurrence of mastitis on project farms (30-50% of cows have suffered mastitis). Especially on the farms of beginners is the incidence of mastitis reportedly high. Most farmers interviewed do not know how to detect mastitis in its early stages. This is because they are not equipped with strip cups. Only a very few farmers owned a teat dip for disinfecting the teats of the animals. Most farmers though aware of such equipment, do not use them. Some farmers have discovered that leaving the calf to suckle after milking reduces the incidence of mastitis.



According to the NDDP package calves are not supposed to suckle from their mothers.

From experience, Ogwanjo discovered that it is possible to dry the cows milk up by using the technique of gradual partial milking, then disinfecting their teats to prevent mastitis. *'This knowledge'*, he said, *'I got from Mr. Odongo who is also a prominent farmer in this region'*.

### **Knowledge and social networks for redesigning**

Knowledge is essentially a social construction that is contextualised and reshaped by the encounters that emerge at the points of intersection between actors' life-worlds. It emerges out of a complex process involving social, situational, cultural and institutional factors. Knowledge is generated and transferred through a variety of mechanisms. The process takes place within a certain conceptual framework and procedures and is affected by various social contingencies, such as the skill orientation and patterns of social interaction characteristics of the particular groups or interacting sets of individuals, as well as of those of the wider audience. In this particular case the domain of knowledge under examination is zero grazing technologies in Siaya district. It is a package developed in a particular knowledge context and then transferred. When presented to farmers, they evaluate the technology and value it according to their own ways of farming. That is, they try to fit it within the framework of their own farming environments. The evaluation is done in terms of resources and food security. It is also put into practice based on practical experience. During a process of continuous evaluation, farmers change the technology by adapting it to their own practices. This is the process through which the NDDP package was redesigned.

In analysing the process, I examined the formation and transformation of the networks in which farmers and extension agents from the NDDP as well as other agencies are embedded. At the beginning, the formation of a network starts with the NDDP staff as they play a crucial role in passing on the technical information that farmers seriously need to engage in zero grazing dairy farming. After evaluation of the technical information, farmers start redesigning it and in the process start to transform the network, going beyond the network of the NDDP to establish links with other actors. The dynamics is then transferred into the community. The reason why farmers transform the network is because individual farmers have different objectives in engaging in zero grazing. First, let me discuss the formation of a network with the NDDP staff before discussing its transformation.

The majority of farmers rely principally on the NDDP extension staff for technical information and knowledge about zero grazing. Most of them received their initial information to start a zero-grazing enterprise from the NDDP extension staff but some farmers like Patrick Odongo and Selina Okeyo

started zero-grazing long before it was launched in Siaya district. They got information through their own social networks of friends and relatives. Other farmers approached the NDDP extension staff to come and design for them the zero grazing unit and brief them on the NDDP package. Selina Okeyo instead used a different extension agent from Kenya Finland Dairy Development programme. The communication network that exists between farmers and NDDP staff is stronger than with friends as far as technical scientific knowledge is concerned. Particularly regarding the NDDP package. At this point the NDDP extension agents play a more crucial role in the type of interactions and links that exist between them and the farmers than the network the farmers are embedded in among themselves.

For other kinds of technical information in dairy farming, farmers rely on Animal Health Assistants (AHAs) and veterinary doctors rather than the NDDP extension staff. This is because they mainly rely on the AHAs for veterinary services despite the fact that many farmers are unable to use their AI services because of its local unavailability and their own inability to detect the silent heat periods of their animals. Nevertheless their ties with the veterinarians are stronger than their ties with other supporting institutions. Apart from farmers like Pamela Oluoch who sometimes use herbs to treat cattle diseases, most farmers rely on veterinary services from the livestock department.

Other technical scientific knowledge also comes from other agencies intervening directly or indirectly in the zero grazing farming system. There is, for example, a strong link between farmers and the CPK Diocese of Maseno West livestock department, which offers extension advice on dairy farming. Oluoch Agulu, Joseph Ogwanjo, Kotoyo, and Patrick Odongo all receive extension services from this source in addition to what they get from the MOALD, ICRAF and CARE-Kenya. There is a strong link between farmers and these organisations. Farmers rely on them for the propagation of fodder trees such as *Leucaena spp.* and *Calliandra spp.* The link between farmers and extension staff of the crops department as far as the NDDP package is concerned can be considered to be weak as they do not deal with livestock as such. However, this network becomes strong when farmers seek technical information on other areas such as crops, and soil and water conservation etc. The link between farmers and the Yala Dairy Co-operative Society and traders are limited to the sale of milk and cattle culling.

In redesigning the NDDP technology package, the kind of social network that emerge pushes the NDDP extension staff and its supporting institutions away from the centre to the periphery.<sup>3</sup> This is because at this point the farmers go

---

<sup>3</sup> Hanyani-Mlambo & Hebinck (1996) have made a similar analysis.

outside of the prescribed norms for practising zero grazing dairy farming. An analysis of the networks for the sources of the knowledge then most useful provides an insight into the scientific and increasingly the local, experiential, and technical knowledge that is drawn upon in the redesigning process.

Some farmers like Patrick Odongo had already received formal training in livestock management. They had acquired what I will call cognitive knowledge, from formal classroom learning. This they combined with experiential knowledge acquired during their dairy farming period to make modifications and changes on the NDDP package. Their knowledge gained from training gave them the confidence to make changes in their zero grazing practices. Mr. Odongo was trained in livestock management as early as 1953 and became a teacher in the same field. He joined dairy farming the following year and now has over 40 years of experience. Mr. Odongo could explain in detail the differences between the behaviour of a normal cow and a sick cow, and could possibly diagnose the disease. His training and experience thus became an asset to him in dealing with the NDDP components.

In Siaya district, there are many organisations intervening in the agricultural sub-sector. Thus farmers receive extension agents from various agencies. All of them pass on scientific knowledge to farmers, which they disseminate in a vertical way (top down approach). This knowledge then diffuses among farmers in a horizontal way, through farmer-to-farmer communication. This type of knowledge has played a big role in redesigning the NDDP package. Farmers receive extension agents from the crops department of the MOALD who demonstrates to them the use of manure on food crops. This automatically implies that farmers will have to redesign the use of manure on napier grass as given in the package. What comes up is competition for manure. Extension agents from the CPK Diocese of Maseno West department of sustainable agriculture propagate the non-use of fertilisers on crop fields and advise instead the use of manure. CARE-Kenya, and ICRAF propagate the use of fodder trees as protein supplements to dairy feeding. This influences the farmers' perception on the use of dairy meal in feeding the animals.

Local knowledge, the other body of knowledge drawn upon during redesigning, is differentiated. It may at best be characterised as body of knowledge based on practical, experiential knowledge. It is a people-derived science, and it represents people's creativity, innovations and skills. Farmers learn by doing, they observe and evaluate the course of events on their own farm and those of others, and use this to change contemporary practices if deemed necessary. Some kind of natural curiosity is practised. This knowledge is enriched through mutual communication and is often inherited and learned from (grand)father or (grand)mother. Local, practical and experiential knowledge is often the source for finding solutions for the particular social,

cultural, economic and/or technical problems encountered in the practice of intensive dairy farming. Unlike scientific knowledge, local knowledge is not commoditised but simply passed on. Furthermore, there exists a body of specialised local knowledge such as in the collecting and processing of herbs from the forest as local medicine for treating cow-related diseases. Such knowledge, however, is not widely available. It is restricted to certain groups of farmers who learned it from their fathers and mothers. In fact it is customary that the knowledge is passed on from father to son and from mother to daughter only. Farmers like Pamela Oluoch who possess this kind of knowledge use it for their own cows and pass it on to their children, and perhaps to fellow farmers as a commodity.

During the process of redesigning, relationships, that may be described as strong or close, with actors other than NDDP or NGO staff - with members of the household, kinfolk, friends, neighbours, experienced farmers, the family and community as a whole as well as with NGO's active in the region - become more and more important in generating and exchanging relevant knowledge and information, whether scientific or local. As indicated earlier with the case of making 'home mixed' dairy meal, schools also play a role with children passing on to parents useful information. The role of experienced farmers like Patrick Odongo appear to be central. Their knowledge and experience is highly valued and forms an important pool of information for other farmers. Farmer's groups and study clubs appear to be crucial forms of organisation for the exchange and enriching of zero grazing knowledge and marketing problems. Pamela Oluoch got the knowledge of *tumbukisa* from the Risasi self help farmers group. The role of the NDDP staff is thus marginalised and no longer crucial for the process of internalising and redesigning zero grazing technology. Relationships between farmers and the NDDP are becoming increasingly weak. This leads to farmers either becoming dormant for the NDDP or to the farmers not receiving extension at all.

Local knowledge and circumstances differentially affect the perceptions of farmers about a technical package. The degree of influence in modifying a management package is related to the degree of influence that indigenous knowledge has on a farmer over its contents. The 'image' of a management package, and consequently the husbandry practices adopted, differs according to the degree of local knowledge it contains. Risk perceptions (technical) associated with the use a complete package of inputs after adoption, and resource competition, partly explains the decomposition of a management package. The assertion of autonomy by local farmers, leading to a continuation of their socio-cultural life, is an expression of their independence from outsiders regarding the use of critical resources for farming.

Farmer perceptions about manure have to do with its wide local use and knowledge before the project intervention. This is seen in all cases except those of Mr. Obongita and Njagi, who practise dairy farming in an urban centre. People use their own shared cultural perceptions and repertoires to shape interventions from outside and to defend themselves from the innovations of outside agencies. They must struggle to retain local relevant knowledge. The use of manure can be used to illustrate this case. As much as it is recommended in the NDDP package that all the manure/slurry produced should be returned to the napier grass fields, the farmers know they also need it for improving their other crops and for regenerating lost soil fertility. The knowledge of manure use is learnt by these farmers in their childhood.

The function of manure in the new innovation (slurry) napier management package has affected the perceptions of many farmers in implementing the package. Specifically it has changed their views, use of, and buying of fertilisers such as NPK and CAN as they have faced problems over time, as fertiliser prices have risen regularly and they are sometimes faced with a shortage of it. The introduction of slurry as a component of the napier management package is associated with redesigning napier management. The effect of slurry on napier was very visible and this influenced farmers to try it on their horticultural crops.

Local knowledge of manure and the amount of manure/slurry to use by farmers is reinforced by their networks with colleagues and the extension staff from the crops department and other intervening agencies. The social network of exchange, reinforcement, redesigning and transformation of local knowledge consists of dairy and crop farmers, and the other institution as well as the NDDP and non-NDDP staff.

Heavily embedded in the experiential knowledge are the farmers' own observations, experimentation, reflections and enquiry. These activities engage farmers at each stage of the technical package adoption or implementation. Their reflections include the appraisal and integration of the acquired knowledge into indigenous technical knowledge systems. The activities have time and seasonal dimensions. Farmers are, historically, innovators in their own right, and seek to preserve their autonomy for the reproduction of their socio-cultural life and calculate technical risk perceptions. An important feature of farmer innovations are their own networks for diffusion of innovations.

Knowledge is an emergent process, and farmers are actively involved in the generation of new knowledge by integrating past and present experiences with incoming innovations. The knowledge acquired from the processes is diffused through farming networks. A farmer would redesign a component package by replacing it with an adapted package from a friend. Such farmer-to-farmer communication is important for redesigning, as we saw especially in the

supplementation of cows feed with *machicha*. All the farmers interviewed showed a tendency to prefer the use of manure as a complete napier management package without supplements of artificial fertiliser. Knowledge for utilisation and skills for action are developed through learning by doing. Human agency is thus a necessary condition. Farmers have developed strategies to overcome serious problems of labour and fodder shortages. Pamela Oluoch is experimenting with a new method of growing napier grass (*tumbukisa*) which is less labour intensive. The family of Mr. Kotoyo is using home mix dairy meal developed out of experimentation at school. Mr. Ogwanjo is weaning his calves using dairy meal and sweet potato vines. Similarly Mr. Obongita is feeding his calves on powdered milk mixed with warm water.

Since knowledge is a dynamic process, and is experience acquired through learning by doing and also learning from others, it can bring differentiation among farmers. Farmers with a large fund of local knowledge display more talent in zero grazing than farmers who have less. Thus farmers like Mr. Odongo who have gone through several cycles of cattle production need to observe and experiment less. Internalised knowledge of past cycles of observations are applied to a new problem. Farmers initially implementing zero grazing were found not to do this. Farmers' experimentation is also initiated primarily to solve direct household constraints. Results are then evaluated through comparison with other farmers or by using their farm record book. Farmers have been shown by other studies to be innovators and researchers (Richards *et al.*, 1986; Chambers and Ghildyal, 1985; Röling, 1990).

The innovative activities of farmers can also be explained by the fact that farmers need their own local knowledge while taking on outside ideas and information (Muma 1994: 60). To be able to maintain production requires a constant generation and exchange of knowledge that fits with local knowledge. Hence local knowledge likewise is a product of the farmers' learning and adaptive processes. Farmers actively stimulate themselves in this process and engage in it with rigour. Relationships with the NDDP and other agencies help also to bring this about.

## Conclusion

A few conclusions can be drawn from this case study. The material presented above reflects empirically what happened and still happens in practice. The central issue is that technology interventions did produce a particular outcome: constraints for one group and new opportunities for others. The rather unintended outcome is that the technology package has been redesigned and that particular knowledge networks have emerged. Only through these practices and new forms of organisation, we may say, has zero grazing been a relative success. The aim and the means of the programme have not always been functional or

compatible with field level circumstances and practices. The field practice, in other words, differs considerably from the drawing board, and more importantly, the farming community appears to be more than merely passive receivers of new technologies. This redesigning was not initially seen by the NDDP as something which produces positive changes embedded in farmer practices. Changes that could moreover be learned. But rather as some kind of defeat or failure, as farmers rarely apply the standard recommendations.

The case material presented here shows two crucial manifestations of the ways farmers look for alternatives and the role-played by zero grazing. During that search for alternatives, three categories of farmers have emerged. First, there are farmers who joined zero grazing with the aim of commercialising the milk production. They saw zero grazing as an alternative to coffee, sugar and cotton, crops that are now less successful in the area. Zero grazing provided another source for generating money. Another group of farmers saw zero grazing as a way to generate money for survival, to pay their children's school and to meet household requirements. The third category, which to some extent includes the first two, joined zero grazing as a way of supplying their need for manure to regenerate soil fertility. Zero grazing also allowed farmers to keep cattle in a context of land scarcity. The latter category saw zero grazing as a way of re-establishing livestock/crop interactions that had been largely lost due to the reduced numbers of African zebu cattle. Accumulation of manure for crop production is one of the unintended outcomes of the project, but the package is also being redesigned so as to fit better with local circumstances, perceptions and interests. In their bid to seek survival options on their own terms, farmers will draw upon the knowledge that outside groups or agencies can offer as they adapt to ongoing processes of change. They have drawn upon two different bodies of knowledge in order to adapt the NDDP package to their conditions – the various government and other agencies, and local expertise and knowledge. Observation and the drive for experimentation, the particular socio-cultural and natural landscape and the passing on from generation to generation is characteristic of this local and regional knowledge. Network analysis shows that farmers are not just recipients and reproducers, but are creative managers and integrators of knowledge and information from diverse sources, including from friends, neighbours, relatives and the community. The exchange with NDDP and other agencies has certainly enriched local knowledge, but it also resulted in a series of culturally embedded interfaces and encounters between scientific and local knowledge that were 'resolved' and transformed during among other things the redesigning process. These social processes and encounters constitute the core of the process of socio technical change 'from below'.

## Agro-forestry innovations: a second soil fertility paradigm?

### Introduction

Agro-forestry is a very recent approach in Luoland to enhancing agricultural development through soil fertility replenishment. The Soil Fertility Replenishment and Recapitalisation Project (SFRRP) is a collaborative design effort between the International Centre for Research on Agro-forestry, the Kenya Forestry Research Institution (KEFRI) and Kenya Agricultural Research Institute (KARI), and implemented together with the Extension department of the Ministry of Agriculture, Non-Governmental Organisations (NGOs) and private sector organisations.

SFRRP is from both a theoretical and practical point of view an interesting approach as it emerged out of critiques of the Green Revolution. While Green Revolution based technologies were critiqued because of their negative social and spatial effects (e.g. increasing social and regional inequalities), SFRRP technologies, such as agro-forestry technologies, have been developed specifically to circumvent the high costs and market incorporation effects of Green Revolution technologies. SFRRP is a central component of what Sanchez (1999: 3) has labelled the second soil fertility paradigm. Developing low cost technologies is a specific rationale of many agro-forestry based strategies. Such a technology trajectory, it is believed, can make a difference to poverty alleviation in smallholder agriculture in Africa. This chapter analyses the technology discourse of the second soil fertility paradigm, by unpacking and describing technologies that fit this label (e.g. improved fallow and green manuring) and by looking closely at the institutional framework of the paradigm.

The chapter follows the SFRRP project from its inception to implementation in order to question whether such projects can indeed make a difference and contributes to poverty reduction, as claimed by its proponents. It is therefore important to first describe the project's discourse: its aims, means, technologies, mode of implementation and perceived outcomes. The context for such an investigation is three villages in Northern Siaya – Muhanda, Nyamnina and Luero. The latter is a pilot village where ICRAF/KEFRI/KARI have been testing SFRRP-technologies since 1995. Again I will make use of farmer accounts to evaluate the impact of this project.



**The background of SFRRP in Western Kenya**

Since 1987, agro-forestry research in East and Central Africa has been designed and implemented under the umbrella of the Agro-forestry Network for Eastern and Central Africa (ECA AFRENA). A pilot approach was adopted by ECA AFRENA in 1994 during a planning workshop held at Mukono, Uganda. Based on the many previous experiences of AFRENA, a diagram was developed to show how to sequence research and development activities in pilot project settings.

Maseno Regional Agro-forestry Research Centre in western Kenya, a collaborative venture between KEFRI, KARI and ICRAF, hosts one of the AFRENA projects. This project is mandated to carry out soil fertility research, to test technologies on-farm, and to disseminate results to the region's farmers. The first phase of the project kicked off in 1994 with the selection of pilot sites for testing relevant soil fertility replenishing technologies. Testing involved setting up on-farm trials to identify which agro-forestry technologies were appropriate. From the outcomes of these trials, it was decided to implement a project in a few pilot villages in the region and to ensure in this way that all the farmers of Western Kenya would benefit from agricultural research. The project was initiated on the basis of the following evaluation and identification of problems.

The first problem identified is the area's generally low phosphorus content, combined with low nitrogen content and localised potassium deficiency. In western Kenya as in many other places in sub-Saharan Africa, fertiliser use has been limited due to poor incentives for agriculture, the lack of farmers' knowledge of appropriate nutrient input packages, and extreme poverty coupled with the absence of rural credit and markets. It is believed that soil replenishment will not occur without government intervention to alleviate these constraints. If properly designed, soil replenishment will generate returns to society over and above those accruing to targeted farmers. These benefits are believed to include increased food security, poverty alleviation, employment, and a range of positive environmental effects (AFRENA Report 1996, AFRENA Report 1997: 59, Niang *et al.*, 1998: 3)

The second problem is the lack of appropriate soil fertility management packages that can be combined with integrated nutrient management practices for sustainable natural resources management in the region. Ongoing academic research on soil fertility associates fertility decline with insufficient nutrient inputs to compensate for extraction rates through continuous cropping, nutrient losses through harvest, soil erosion and leaching (Smaling, 1993; Swinkels *et al.* 1997: 100; Franzel, *et al.*, 1999: 309; Mango, 1999: 1). Farmyard manure is not sufficient and the use of mineral fertiliser is mainly restricted by a lack of cash.

Because of this most households are only able to secure enough food from their own production for between three to nine months per year. Alternative ways of nutrient management therefore need to be designed to alleviate the problem. Scientists from ICRAF, KEFRI and KARI at Maseno have taken up this challenge and developed several low cost soil fertility management technologies such as biomass transfer, improved fallow and a combination of these with the application of inorganic sources of phosphorus. Evidence mainly from researcher managed trials in western Kenya indicate that improved fallow, especially in conjunction with high doses of phosphorus, are not only effective in increasing maize yields, but financially attractive, with an increase of \$457 per hectare over continuous maize production (AFRENA Report 1998: 18). Outstanding results have also been realised from large applications of rock phosphate with *Tithonia* in the first two seasons of cropping. Biomass transfer systems with *Tithonia* have been found to significantly increase crop yields and to be very profitable with high value crops such as vegetables. The benefits of their combinations as well as integrating them into soil conservation practices have been tested on-farm by researchers and farmers and have shown that integrated soil fertility and soil conservation practices enhances productivity in a sustainable manner and reduce soil loss significantly (*ibid.*: 19-28; see also Jama *et al.*, 1999).

The third issue that emerged from previous experiences with soil fertility programmes was a general lack of understanding of the socio-economic issues related to their adoption and management. There appears to be a specific knowledge gap with respect to the role of soil fertility management in rural household livelihood strategies. There is also inadequate knowledge on the incentives required to induce communities and households to invest in natural resource management and on the most effective ways to improve these incentives (AFRENA Report 1997: 18, AFRENA Report 1998: 3).

A fourth area of concern that the diagram addresses is how to 'empower' communities and groups to enable the uptake of such technologies and even promote investment by farmers in natural resource management. Mechanisms have also to be worked out between the different partners (researchers, extension workers, NGOs and farmers) to ensure a rapid and large-scale dissemination of knowledge and technologies for integrated soil fertility management. It is believed that if such an approach is embedded in farmer's traditional social structures it will catalyse wide adoption (AFRENA Report 1997: 19; AFRENA Report 1998: 3).

The overall objective of the project is to reduce poverty among farmers in western Kenya through a collaborative effort and through strategies that can raise soil fertility levels. The effort will include incentives and means (which will be specified later in the chapter) for farmers and communities to achieve

the transfer of knowledge and technologies, maintain the levels of these being used and further invest in soil fertility improvements (AFRENA Report 1998: 4). Agro-forestry technologies developed at the regional Agro-forestry research centre Maseno have to reach the end users - the farmers. The project assumes that these collaborative efforts can help to break the poverty cycle now pervasive in western Kenya.

The main beneficiaries of the pilot project are the smallholder farmers, particularly those that have poor access to resources, female headed households and widows, and small agricultural input dealers.

The soil replenishment strategies to be considered are based on four principles generated by research. These are:

1. That there is a need for external inorganic phosphorus input.
2. That households can produce the nitrogen and potassium required through organic sources on their farms.
3. That large economic gains to households can be realised through the addition of improved agricultural practices (integrated pest management strategies, high value trees and crops, improved seeds and good husbandry) on the replenished soils and
4. That soil conservation is a prerequisite for any sustainable soil fertility improvement strategy.

The project began in February 1994 on four sites in Western Kenya: Vihiga, Kakamega, Siaya and Kisii Districts. Each site consisted of a cluster of one to seven villages. The sites were selected because of their bi-modal high rainfall (>1500mm/year), a known phosphorus deficiency, and because farmers themselves had identified poor soil fertility as a major constraint for crop productivity. The pilot project uses the village approach to be reach and thus work with a wide range of farmer categories. Presently, the project collaborates with 17 villages subdivided in three clusters. Six of the villages are in Siaya District, ten are in Vihiga districts and one is in Kakamega district. Some of these villages are presently being phased out, and ICRAF and others have moved to what is called upscaling their activities: not specifically targeting a village but focusing on certain individuals in the community.<sup>1</sup>

This approach was supported by various studies, by using participatory rural appraisal techniques such as wealth ranking; stratification etc., to characterise farm and households in socio-economic terms, by describing the biophysical resources available, doing on-farm testing, and by monitoring exercises to assess adoption and impact. The activities are funded by the European Union,

---

<sup>1</sup> These individuals are now being labelled by the villagers as 'ICRAF agents' (Pamela Opiyo and Wesley Ongadi, pers. comm.)

Rockefeller Foundation, Dutch foreign aid, the World Bank as well as ICRAF, KEFRI and KARI core funds.

The mode of operation is supposed to be highly participatory, both between research partners, and between researchers, development agents and the farmer's community. This participatory emphasis requires significant investment in network building and communications especially at the onset of the project. In the appointed villages the project has set up committees with nominated community members. The role of these committees was to discuss how the project would be implemented and to act as a discussion forum. To foster sustainability, the project liaises with the local private sector to seek ways of strengthening markets for credit, inputs, and outputs. In particular the project established links with SCODP (Siaya Community Oriented Development Programme), involved in selling farm inputs to farmers, and with similar organisations to increase the availability of inputs and improve marketing of outputs, and with local and international NGOs that deal with credit to develop smallholder agricultural credit schemes to catalyse adoption and impact. Phosphorus inputs are purchased by the project through local input suppliers where possible and used for wide-scale community based on-farm trials. These trials are used at the same time for demonstration purposes and to increase awareness and create demand. Farmers themselves invest labour, land and possibly help in the construction of soil conservation structures (where necessary) and in producing organic nutrient inputs. The organic materials are produced mainly from agro-forestry technology species whose plant material (seeds) are provided to communities by the project directly or indirectly through the development agencies.

### **The Second Soil Fertility paradigm in practice**

Typical for the Second Soil Fertility paradigm is that the technological discourse is emerging and is not a straightforward process of technological design. It has evolved gradually, step by step and in continuous trials both on-farm and on-station. The technologies generated by ICRAF and others were developed sometimes together with farmers, sometimes based on what farmers 'traditionally' were doing in the field of soil fertility, and sometimes enriched with exogenous resources. The SFRRP technologies that will be discussed here are green manuring and improved fallow. The description of these technologies is based on the accounts of researchers or 'experts' and of extension workers.

#### *Green manuring and transfer of biomass*

The majority of soils in Western Kenya are deficient in nitrogen, and maize is a major consumer of this nutrient (Smaling, 1993; Ogaro *et al.*, 1997; AFRENA, 1996). Manuring with green biomass was therefore one of the technologies

proposed to farmers by the project. Green manuring refers to the transfer and working into the soil of biomass, using the foliage of selected trees, shrubs and other non woody plants rich in water, sugar, starches, protein and nitrogen as organic fertilisers (Kahnt, 1983). The species used should have an extremely high capacity for assimilating nutrients from the soil. The biomass is then applied to the field. A regular flow of nutrients becomes available for the crop when the organic matter is mineralised under normal decomposition conditions.

One of the most popular agro-forestry practices in the research area is a hedge to demarcate boundaries of fields, farms and compounds. These hedges protect soils and crops as well as producing fodder, mulch and green manure. The most common species for hedges are *Tithonia diversifolia* (wild sunflower) and *Lantana camara* (tick berry). *Tithonia* is also found along roadsides and on fallow land. Both species produce large quantities of biomass that can be incorporated directly into the soil as green manure or used as mulch. Farmers cut leaves and soft twigs of *Tithonia* from the hedges, chop them into small pieces, and either places them in each planting hole or spread them evenly over the surface before incorporation into the soil. The leaves must be mixed well with the soil or left to decompose for at least one week before planting. Maize and other seeds may not germinate well if planted immediately after applying green manure. Farmers continuously apply this green manure during the growing period of the crop either by placing it along the rows of plants or by incorporating it into the soil.

*Tithonia* as biomass manure was the farmers' own discovery, and later taken up by CARE-Kenya in 1992 after a research needs assessment with the farmers. This was long before ICRAF started the SFRRP. Bruno Oteke, an agro-forestry extension worker with CARE-Kenya since 1986, told us that in 1992, they set up an adaptive research department on realising that farmers were not keen to take up tree growing as per their recommendation. '*The farmers priority was first to meet their household food security needs*'.

However, because CARE-Kenya was not dealing with crops at the time, it was difficult for them to do something in this area but 'We could see farmers struggle to identify the right maize seeds to grow other than hybrid maize. Crops that had almost been neglected by farmers were also now resurfacing in farmer fields'. Oteke mentions that because of this CARE-Kenya decided to engage in a farmers' needs assessment in order to identify the areas in which they could intervene.

*'The result of this survey, he says' was that farmers needed more help in identifying a local variety of high yielding maize that would require a low input means of improving the fertility of their soils. It was after this survey that I was made an Adaptive Researcher in this region. My task was to carry out research with farmers on local maize by screening them and aiding in*

seed selection. It was also in 1992 that we identified the wild sunflower weed (*Tithonia diversifolia*) as potential green biomass manure for this area.'

CARE-Kenya then set up an adaptive research wing linked with an extension approach popularly known as the village-approach. Its extension workers help farmers to form groups with whom they can work in the village. This group democratically elects a Group Resource Person (GRP) who is trained at various seminars by CARE-Kenya. The GRP in turn trains the rest of the group members, who are called Adaptive Research Farmers (ARF).

Bruno and his colleagues told how they had come across *Tithonia* during their research with farmers to identify potentially useful weed species for soil fertility. They hoped that by tapping local knowledge, they could increase the range of options available to farmers for reversing the area's declining soil fertility. But significantly:

'Farmers came up with a list of over 10 species, of which *Tithonia* was only one. But several farmers said that, when they cleared land on which *Tithonia* had been present, their crops grew well there.'

They then discovered with the farmers that *Tithonia diversifolia* (wild sunflower) and *Lantana camara* (Tick berry) produced large masses of foliage that could be used as green manure. Farmers themselves had also made these observation when they planted maize in areas where these weeds had been cleared. Researchers from ICRAF/KEFRI/KARI picked up on this and began trials at the nearby Maseno station to investigate the potential of these species. *Tithonia* was preferred because it produces large amounts of biomass within a very short time. ICRAF then established a collaborative mission with CARE-Kenya.

To western Kenya's farmers, *Tithonia*'s use as biomass manure is not so much a new technique. It is over 100 years since the shrub, a popular ornamental, first arrived in the region from southern Mexico (AFRENA, 1996: 8). According to Patrick Odongo, a farmer in Muhanda village, this flower could have been brought in through a network of missionaries.

'I first saw this plant in St. Marys Catholic Mission, Yala. It was planted as a flower around the houses of the missionaries. The next place I saw it was in Maseno mission, which was being run by the Church Missionary Society and for the third time, I saw it in Butere Mission. Now it flourishes widely as an attractive hedgerow species, marking field and compound boundaries with a mass of foliage and a splash of bright yellow flowers. The shrub also has medicinal value as we use it to alleviate stomach upset and to treat stomach aches. We sometimes feed it to livestock as it can treat other ailments – but these uses are far from common.'

Dr. Agodo Ojwang, a senior research scientist with ICRAF-Maseno, mentions that *Tithonia* leaves contain 50% more phosphorus than legumes, and similar levels of nitrogen and potassium, even though *Tithonia* is not a nitrogen-fixing plant.

*'My trials in farmers' field showed that the farmers were right: Tithonia-fertilised plots gave higher maize yields compared to non-fertilised and even conventionally fertilised control plots. This surprised us.'*

Dr. Agodo further mentioned that the foliage of the fast-growing *Tithonia diversifolia*, is rich in nitrogen and contains some other essential nutrients including phosphorus, potassium and calcium.

*'Combining Tithonia biomass with rock phosphate on soils low in phosphorus has been found to be an effective way of restoring soil fertility. This inexpensive and readily available alternative to purchased fertilisers is increasingly becoming important in improving yields of maize and high-value crops such as tomatoes, kale and French beans. This technique has been welcomed with enthusiasm by farmers in Western Kenya, where Tithonia is abundant and the soils are degraded'.*

The on-farm trials indicated that one hectare requires five tonnes of *Tithonia* biomass.

*'Our own experiments show that it takes about 4 minutes to cut 1 kg of fresh Tithonia and one person can harvest 83-120 kg a day. In terms of labour requirement, the result of labour analysis shows that the application of 5 tonne Tithonia would require about 370-work days/ha while the application of inorganic fertilisers or animal manure costs between 1 to 7 work days/ha. Further our experiments have shown that a combination of Tithonia and rock phosphate perform better than Tithonia only. The average maize yield on the 27 farms in Luero village, one of our pilot villages, was 1378 kg/ha for the combination of Tithonia and rock phosphate and 807 kg/ha for Tithonia only. The bean yield was 809 kg/ha for the treatment combining Tithonia and rock phosphate, while the control produced 528 kg/ha. We obtain rock phosphate from Minjingu in Tanzania and it is not available in the local markets. Between 1996 and 1999, we have provided it free to farmers who offered their land for on-farm trials. The challenge is to create awareness on the benefits of rock phosphate and to assure that it will be available from local traders. For sustainability, it requires normal processing, packaging and subsequently regular sales in the market.'*

#### *Improved, short duration fallow technology*

In order to restore soil fertility, land should remain under fallow for several years, as the natural vegetation is slow to reach peak productivity. An alternative technology is to introduce new tree species for fallowing, which produce biomass more rapidly (Prinz, 1986). These species produce wood and enhance soil fertility by bringing up nutrients from lower soil layers through litter fall and by atmospheric nitrogen fixation. At the end of the fallow period, the trees are harvested and the biomass that cannot be used as wood for fuel is returned to the soil, enhancing its fertility.

Natural fallows, which normally consist of a combination of broad-leaved weeds and grasses, are used to restore soil fertility or to provide fodder for livestock but their effectiveness is low. Recent results have shown that improved fallow systems with fast-growing tree or shrub legume species like

*Sesbania sesban* have a high potential to restore soil fertility and have become a central agro-forestry technology for soil fertility management (AFRENA Report 1997). These technologies can be useful to resource poor farmers in western Kenya who cannot afford to buy fertilisers and do not have livestock for manure. *Sesbania* has been the main focus for this technology partly due to its long traditional history with farmers and for its compatibility with crops, deep rooting, and supply of additional wood products and large benefits to maize planted after the fallow. More recently other species such as *Crotalaria grahamiana* and *Tephrosia vogelii* have been tested with some success in the region (*ibid.*). Improved fallow can take different forms.

The first involves the establishment of a six-month fallow. The preferred crop, usually maize, is planted during the long rainy season (April-July). After the harvest, an improved fallow species such as *Sesbania* is planted on the same piece of land during the subsequent short rains (October-December). Researchers estimate the optimum density for *Sesbania sesban* to be about 20,000 plants per hectare. At the end of this season the fallow is cut down, and a crop of maize is planted on the same land in the next long rainy season.

The second technology is based on a fallow period of one year. Species such as *Sesbania sesban*, *Crotalaria grahamiana* or *Tephrosia vogelii* are planted between the maize rows during the long rains. When the maize crop is harvested, the fallow is left to grow right through the short rains and is cut at the end. The land is then cleared for a new crop of maize during the following long rainy season. In both cases, farmers lose only one growing season (the short rains), which is a period when crops might easily fail because of reduced rainfall. According to researchers, this loss is supposed to be compensated by a threefold yield increase in the following season. However, both the long and short rains are unreliable and farmers do not want to take the risk of leaving their entire field fallow. Instead they prefer to grow these shrubs on a small part of their farms or as a hedge around the field.

In my conversations with Dr. Agodo Ojwang, I learned that short-duration improved fallows of 6-12 months increase the yield of subsequent maize crops by 1-3 t/ha in the first season compared with continuous maize cropping or natural weed fallows, with subsequently lower benefits in years two and three. The processes by which improved fallows achieve these benefits are by: a) accumulation of large amount of nitrogen rich biomass which is easily decomposable and hence releases nutrients rapidly into the soil, b) improved soil organic matter and soil structure (noted by easier tillage operations), reduced erosion and improved weed suppression in dense fallows such as *Crotalaria grahamiana*, c) *Sesbania* fallows, which have a very deep root system and thereby effectively capture mineral nitrogen which has been leached below the crop rooting zone. This leads to a better recycling of nitrogen and reducing



nutrient losses, d) leguminous fallows additionally enrich soil fertility through the process of biological nitrogen fixation (BNF). According to him, in this process the plant forms a symbiosis with soil bacteria called *Rhizobium*, which is able to transform nitrogen from the air into ammonium, which the plant can assimilate. To identify plants that are effective in fixing nitrogen, Dr. Agodo Ojwang told us they look at the appearance of nodules on their roots. '*Actively nitrogen fixing nodules have a pinkish interior colour. The inputs from BNF and deep soil nitrogen capture provide sufficient N for the subsequent maize crop without necessitating N fertilizer additions.*' He added that,

*'The roots left in the soil decompose gradually, releasing nutrients to the subsequent food crops several seasons later. At the end of the fallow period the trees or shrubs are cut down to provide fuel-wood, stakes for supporting climbing plants, or building poles. Besides replenishing soil fertility through their litter and nitrogen fixation, improved fallows of sesbania are known to reduce levels of the parasitic weed Striga hermonthica in the soil significantly.'*

The high price of commercial fertilisers heightens the urgency of the search for alternatives. Dr. Ibrahim Obizoh, principal research scientists with the KEFRI/KARI/ ICRAF project, recognises that lowering the costs of restoring fertility is vital to the future of agriculture in the region. But aside from the cost argument, there are other good reasons for diversifying farmers' soil fertility options. '*In a region like western Kenya, nutrient deficiencies are multiple. That means we need a cocktail of techniques in which synergies can occur*', says Dr. Obizoh. '*On both counts, commercial fertilisers alone are clearly not the answer. Agro-forestry technology has a big part to play in providing alternatives.*'

In 1994, Dr. Obizoh and his colleagues began screening trials at Maseno to identify promising tree and shrub species that would enrich the soil by adding nitrogen during fallow periods. Three species, *Sesbania sesban*, *Crotalaria grahamiana* and *Tephrosia vogelii*; showed particular promise, producing large amounts of leafy biomass that, when incorporated in the soil, led to a sizeable gain in the yield of subsequent maize crops. Dr. Obizoh had been exposed to these trees and shrubs earlier as a researcher in Madagascar and Cameroon. Therefore he did not hesitate to introduce them to Kenya where a similar trial was going on with *Tithonia*, and indigenous species of *Sesbania* and other trees. On-farm trials in Luero, a pilot village in 1996, showed that researcher-farmer-managed plots were capable of producing the same results. According to Dr. Obizoh,

*'the improved fallows provide more than enough nitrogen for a following maize crop, but the yield increases could be still higher if another deficiency, phosphorus, could be overcome. Again, the imperative is to drive farmers' costs down. The recommended form of phosphorus application at present is triple superphosphate, whose price is the equivalent of KSh.130/kg phosphorus. Rock phosphate, in contrast, costs only the equivalent of KSh.65/kg of phosphorus.'*

*Farmers perceptions of green manure technology*

Most farmers in the research villages at the time of my research applied less than the recommended rate of 5 tonne *Tithonia* biomass per hectare (see also AFRENA, 1996). As cutting and transporting are laborious tasks, most farmers planted *Tithonia* along borders, boundaries and contour lines. This ensures a constant nearby supply of biomass, reducing the labour needed to carry it to the fields. The technology is used by 120 farmers on a total of 2.3 ha (see Table 8.1). Half of the farmers in Luero village, and almost all the farmers in Muhanda and Nyamninia villages, thought biomass transfer required much more labour than the other technologies used for improving soil fertility. Farmers who used *Tithonia* on high value crops like kale, beans, and tomatoes reported good responses. They told me that kale produced more leaves, which are big and dark green, beans produced big pods and the tomato plant produced several big fruits and had a longer life span. However, they complained about the labour input.

Martin Onanda (see case 2 chap. 3) Luero village headman agrees that for small-scale farmers, SFRRP technologies are better options for improving soil fertility.

*'However, they are quite labour intensive. In a plot of 10m x 10m we need six 70kg sacks of Tithonia leaves. They give you what you want if you add farmyard manure. They can triple the yields. If Tithonia is used in a field of tomatoes, from an area of 20m x 20m without any disease attack, you can get up to KShs 40,000.00 if there is no serious disease attack.'*

Martin got KSh. 8,000.00 from a plot of 10m x 10m where he used *Tithonia* to plant kale. In the same plot when he used rabbit manure, he got KSh. 3,000.00.

**Table 8.1: Number of farmers experimenting with improved fallowing and transfer of biomass in the three villages (1998)**

Villages	No. of farmers practising improved fallow	Total plot sizes (m <sup>2</sup> ) covered	No. of farmers practising biomass transfer	Total plot sizes (m <sup>2</sup> ) covered
Luero	73	23,233	30	11,834
Muhanda	17	18,129	50	7,993
Nyamninia	68	10,204	40	3,268

Source: own survey 1998

Alice Ambajo from Luero village was transferring biomass even before ICRAF/KARI/KEFRI and CARE-Kenya introduced it in the region. However she states that she applied it in a different way.

*'Because they had naturally grown around my plot and formed a hedge, I just used to cut them and allow them to rot in the field during land preparation. When doing primary cultivation, I could then incorporate them into the soil. However when I started using the ICRAF way of incorporating the leaves in the soil while still green, I found it quite labour demanding but the yields from maize were far better than before.'*

In order to reduce labour for transporting *Tithonia* leaves to other plots on the farm, Alice has partitioned these plots with *Tithonia* hedges forming intra-plot boundaries. Before planting maize, Alice chops the *Tithonia* into small pieces with a machete. She then applies a handful into every seed hole. Alice started using *Tithonia* the ICRAF-way in 1997. Before she started using it she had observed low harvests in areas of her fields where the leaves of this plant did not fall. This always coincided with the middle portion of the plot. Parts of the plot that were close to the hedge registered very high yields.

*'I could observe the maize growing in areas next to the fence surrounding my plot being healthier than the ones growing towards the centre. I knew it was the effect of akech (Tithonia). However I did not think of incorporating it into the soil in areas closer to the middle of my plot until ICRAF started teaching us their new method. This method works but it requires that you use Tithonia every planting season as it does not stay in the soil for long like farmyard manure. It is an option for us poor farmers without livestock and money to buy fertiliser.'*

Alice does not apply the advised dosage of 5 tonnes per hectare because she lacks the labour to do so.

*'In some places in the farm I do not apply a handful of Tithonia per hole, instead I just spread the plant as before and when digging, I cover them with soil. I need two people to put the green manure per hole on the entire farm. I do not have the money to pay for that'.*

Dorcus Kidha, who also resides in Luero village, prefers using *Tithonia* because apart from increasing the soil fertility, it also suppresses the growth of obnoxious weeds such as witch weed (*Striga hermontheca*), couch grass and other grass weeds. The only hard job is chopping it into smaller pieces or bringing it from a distance to the field. Dorcus explains how ICRAF staff taught them how to use *Tithonia*. *'First make a hole where you want to plant your seeds, place a handful of chopped Tithonia, add a little soil to cover Tithonia, place the seed and cover the seed with top soil'.*

Dorcus is now 75 years old and she complains of general malaise. She cannot follow all these steps. Instead she also has decided to make hedges along the contours of her farm using *Tithonia*. She explains that it was just sheer luck.

*'When ICRAF researchers started working here in our village, they first asked the Divisional Soil Conservation Officer to mark areas to dig terraces along our plots. In my plot they were using Tithonia sticks to mark which parts to be dug. However, I was very sick during that period. My son, Gandhi, was also ailing and died from his sickness. He left a widow with six children. During this period the Tithonia sticks germinated and formed hedges in the field. When ICRAF personnel were teaching farmers how to use the Tithonia on their farms, they*

*discovered that when Tithonia stools merge, their roots can form a very strong barrier to soil erosion. A field day was quickly organised on my farm to teach farmers who did not have the labour to dig terraces how they could stop soil erosion. Dr. Obizoh from Maseno Agro-forestry Research station gave me KSh. 10,000.00 for this new discovery. Since then they have been using my plot for demonstrations'.*

Dorcus Kidha states that in this way she has managed to save labour for cutting *Tithonia* biomass from other places. She adds that for the instructions to be followed effectively as they were taught, this work needs two to three labourers. That is, one person to make the holes, the second person puts *Tithonia*, the third person adds soil then all of them can put the seeds in the soil and cover. *Tithonia* is cut and thrown into the field. Through this, the biomass decomposes and enriches the soil with nutrients. *Tithonia* is used as a cover crop and also as green biomass manure. Farmers have planted them in their farms as internal boundaries.

Most farmers nowadays plant *Tithonia* the way Kidha does. She states that crops grown this way grow very fast and look healthier.

*'Their leaves are big and dark green, they yield large, healthy and clean seeds. Crops planted without Tithonia yield small seeds, and the crops don't look healthy'.*

While researchers would like to test this technology on hybrid maize, most farmers and in particular male farmers prefer to use it on high value crops because of the higher returns for their labour. However, they were also quick to mention that when many farmers grow the vegetables at the same time, then they lack markets to sell them.

Bernard Anjejo is a farmer in Luero village. Every Tuesday and Friday during the season, he harvests vegetables from the plots surrounding his homestead and takes them to Yala market some three kilometres from Luero village. Some he sells to villagers at farm gate. *'The market is good right now'*, he says. *'Traders are also coming to my farm to buy vegetables and I'm supplying local schools.'* It wasn't always so. Anjejo's produce, and its profitability, have increased markedly in the past year or so, thanks to new agro-forestry technology introduced by ICRAF and its partners. Anjejo has noticed that he gets *'nicer green leaves'* when he applies *Tithonia*. Traders too notice the difference and offer higher prices for the better quality. With both the quantity and quality of his harvests up, Anjejo says his income has risen since he started using *Tithonia*.

To Anjenjo and farmers like him, the price tag attached to soil fertility is all-important. Standard recommendations for commercial fertiliser applications to maize in western Kenya are 60 kg N and 50 kg P<sub>2</sub>O<sub>5</sub>/ha a season, costing around KSh. 11,000 (US\$ 141)/ha a year for the two rainy seasons. But more than 60% of farmers in the area earn less than KSh. 30 (US\$ 0.38) a day from their land. That means that farmers are being advised to spend an unrealistically large part of their annual income on fertiliser.

Oduor Lomo (case study 1, chap 3) is an adaptive research farmer with CARE-Kenya. He has planted about 2,000 seedlings of kale in his plot. This he has done using homemade manure from *Tithonia*. First he has used the plant to practice what he calls under mulching. In this type of farming, Oduor first digs furrows where he puts the cut *Tithonia* leaves. These are then covered with topsoil to form a ridge. On top of the ridge he then plants the seedlings. This is a very new way of growing kale (*sukuma wiki*) in this area. It prevents soil erosion and water logging since the water streams off through the furrows. He incorporated maize stalks in the furrows to fertilise the soil and improve the water absorbing capacity of the soil. He applies *Tithonia* at the roots as a sort of top-dressing. He says that this technique of growing kale is his own discovery.

*'CARE-Kenya has also picked up this technology from us. The good thing with CARE is that it adjusts its activities to the resources farmers have. Better than the empty dreams the government extension is providing. Use of Tithonia as fertiliser fits well with the farmers around here. When we pound the leaves and mix with some poultry faecal material and then ferment for one week in a container half filled with water, we get very good manure from the mixture. The filtrate we use directly as a top dress. The residue we use as ordinary manure. It is my guess that young Tithonia could be very rich in nitrogen and the old Tithonia plant could be very rich in phosphate. Both are beneficial to plants.'*

Lomo's brother, Oketch Bundmawi, claims that he is the one who discovered the weed *Tithonia diversifolia* as a potential plant for making organic manure. Later on extension workers from CARE-Kenya took it up and were advising farmers on its benefits.

#### *Farmers' perceptions of improved fallow technology*

In collaboration with extensionists and researchers from ICRAF, KARI and KEFRI Maseno, 158 farmers in Nyamninia, Muhanda and Luero villages (over 10% of all households) are experimenting with two methods for improving fallow on some 6.1 ha, combined for the three villages (see Table 8.1). As Luero village headman, Martin Onanda says, it is a labour demanding method and 'you must have planted a lot of the shrubs in order to realise your objective'. They are required to apply an unknown amount of Minjingu rock phosphate. The blanket application of this phosphorus rich mineral, leaves farmers in doubt about the performance of the improved fallow technology. They believe that without the rock phosphate, the yield will not be as high as researchers argue. Jacob Oywa Yuke, a farmer from Luero and others like him who planted these shrubs and never applied any inorganic fertiliser confirmed this.

*'The fertility of the plot is not really guaranteed if you rely on the shrubs alone without adding inorganic fertiliser. Thus we would prefer using local maize instead of hybrid maize with these trials.'*

In farmer-researcher managed plots, hybrid maize is used as a trial crop. However, most farmers maintain that even if they were getting small cobs, they would prefer to use local maize. Martin claims that, '*using local maize in a soil with much reduced soil fertility is far better than hybrid that gives nothing.*' Farmers in Luero find it easy to grow sweet potatoes in soils with low fertility.

Martin does not grow hybrid maize. He planted hybrid 512 only once, in 1988 during the long rainy season. It was planted in a fallow of *sesbania*. The maize did well and was producing two cobs per plant. However, Martin did not benefit from this as thieves were stealing his maize when it was still green. This discouraged him. Trees such as *Calliandra colthyrsus* can also be used as fodder trees. Martin has developed new applications for the legumes that no formal-sector researcher would ever have thought of. By adding the freshly picked leaves of *Crotalaria grahamiana* to his fishpond, he finds he can attract insects the fish like to feed on.

*Tephrosia vogelii* is also being used to scare moles. Where farmers have planted sweet potatoes, they have also planted *Tephrosia* as external boundaries around the sweet potatoes plot. *Crotalaria grahamiana* also suppresses the growth of *striga*, couch grass, and is capable of killing nematodes in the soil. Martin claims that *crotalaria* normally exudes chemicals in the soil that are lethal to nematodes. He says that this was taught in a seminar in Nairobi. Most tomato diseases are also not found on places where *Crotalaria* is planted. *Tephrosia* has long been used in the region for fishing in the streams. When fish drink the chemical they become dizzy and float on top. When used in low dosage in fishponds, it turns the fishpond green and predators of the fish cannot see them. The introduction of new species to the area has led also to the build up of new pests e.g. caterpillar attacks on *Crotalaria grahamiana* are now more often observed than before. Recent evidence suggests that the indigenous *Sesbania sesban* together with *Tephrosia vogelii* is a host for root-knot nematodes (nodule like but not easily rubbed off), which also affect common beans and hence it is recommended not to plant beans in the first season after these fallows. Thus increasing the bio-diversity of the system by using mixed species fallows is essential to ensure sustainability of the production system.

When in the fields with Martin, we came across Mama Dorcus Kidha harvesting her *crotalaria* to renew her soil fertility. Wandering in her plot, we saw her covering the roots of the shrubs in the soil. She told us that as the roots themselves rot, they also improve the soil temperature. She agrees that it is better to have improved fallow as natural fallow takes too long to improve soil fertility and that,

*'although Crotalaria does not clear striga completely in the farm, it reduces its effects on maize. When the canopy of Crotalaria plants shrub merges, they form a very effective shade that smothers weeds like couch grass.'*

*Crotalaria grahamiana* leaves a lot of biomass and it kills the couch grass, which competes with crops, but the caterpillars feeding on its leaves reduce the leaf biomass. This pest is the caterpillar of a certain butterfly, which was not spotted in the village before the introduction of these shrubs. It is believed to have appeared when the shrubs were introduced. Dorcus complained that the pest is also attacking their indigenous vegetable Mito (*Crotalaria brevidens*), which belongs to the same family as *Crotalaria grahamiana*.

Following the farmers' complaints about the pest now feeding on the *crotalaria* and their crops, ICRAF provided chemicals to farmers to spray the pests. This did not prove very effective. By the end of my research, ICRAF had turned to practising mixed species fallows, mainly because improved single species fallows might fail due to adverse weather conditions (drought, logging) or establishment failure (poor seed quality or lack of proper seed pre-treatment). The more resistant species will at least partially compensate for the low yield or failure of the susceptible species. Some fallow species are less effective in capturing subsoil nutrient or nitrogen fixation than others. Reduced insect attacks have been reported in mixed compared to single species fallows but further investigation and testing by farmers are needed. *Tephrosia* impedes the presence of mole rat, which does not like its smell, and because of this most women farmers state that they like planting *tephrosia* around their sweet potato plots. Sweet potato vines also increase soil fertility when they decompose in the soil.

Dr. Ibrahim Obizoh, a principal agro-forester with ICRAF, told us the other advantages of mixed species improved fallows are the multiple use of products. *Sesbania* fallow produces a large proportion of wood (80% of biomass), appreciated by the farmers, who are deprived of firewood. However, the partitioning of resources into wood leads to a lower amount of foliage returned to the soil and leads to the export of fixed nitrogen from the plot (30%). Mixing *sesbania* with *crotalaria* ensures both the benefit of wood as well as a large production of foliage biomass. A second advantage is the improved utilisation of available resources. The tall *sesbania* with an open canopy mixes well with the lower but dense growing *crotalaria*. This potentially also leads to better light utilisation. Mixing the deep-rooted *sesbania* with *crotalaria* led also to better subsoil mineral nitrogen exploration. Thirdly, Obizoh argues that a maximisation of fallow yields has a prolonged residual effect. Yields do not necessarily increase under non-stress conditions. However, where maize was sown under *sesbania*, *crotalaria* and *tephrosia*, large yields were observed. Mixing species of different leaf qualities and decomposition rates may reduce nitrogen losses and extend the time of residual effect.

Since Dr. Obizoh and his colleagues at ICRAF-Maseno are convinced of the advantages of mixed species improved fallows, and its potential to address

farmers complain about pests, they recommended the following species combinations to farmers.

1. For recycling of deep soil nitrogen, high inputs from biological nitrogen fixation and a wood component: *Sesbania sesban* + *Crotalaria grahamiana*.
2. To maximise fallow biomass production or to provide a fodder component: *Sesbania sesban* + *Calliandra calothyrsus*
3. For production of food crops during the fallow period: *Sesbania sesban* + *Arachis hypogea* (groundnut) or *Cajanus cajan* (pigeon peas) + groundnuts. As *sesbania* and *cajanus* have an open canopy during the early establishment, a short duration groundnut variety can be planted in between the *sesbania* rows during the short rains (groundnut yield is about half of pure groundnut stands).
4. Other successful combinations: *Sesbania sesban* + *Crotalaria grahamiana* + *Tephrosia vogelii*.

Researchers however encourage farmers to test other combination for their suitability to their particular needs. Despite the fact that farmers are not keen on using inorganic fertilisers due to their cost and adverse effects in the soil, researchers still stress that to ensure optimal use of the improved fallow the subsequent maize should be fertilised with 50 kg phosphorus per hectare as most soils in Western Kenya are strongly phosphorous deficient. At the end of my research period, scientists were still investigating these recommendations and farmers were still trying them out.

ICRAF has also arranged with Siaya Community Oriented Development Programme (SCODP) to supply rock phosphate to farmers at a cheaper and affordable price. The proposed selling price for 50-kg bag of rock phosphate was KSh.750 This is almost half the price of what a 50-kg bag of other fertilisers cost. Most farmers mention that rock phosphate does better than DAP. By the end of the research, rock phosphate was still being offered free to particular farmers.

### **Luero: the ICRAF village**

Luero is situated in Sauri sub-location, in the extreme north east of Siaya District bordering Kakamega District. It accommodates eight villages of which Luero is the smallest. There are three main clans in Luero - Kalanyo, Ndagariya and Kathomo. Kathomo is the biggest and is the clan to which Martin Onanda, the village headman, belongs. Martin pointed out that ICRAF came to the village with agro-forestry programmes for the first time in 1991 and was promoting the planting of trees. This was before the pilot project started. They first worked with women's groups to disseminate their technology. A Dutchman, Coen van Vliet, who worked for ICRAF at the time, started planting



trees in alley cropping. Martin worked with him and took care of a tree nursery. Martin also established a tree nursery in his grandfather's compound. Mr. Coen started by planting *Gravillea*, *Causarina*, *Caliandra* and *Sesbania* and these are still a living testimony. Martin stated that

*'sesbania sesban was given to three farmers as a start. In 1992, the area where it was planted did so well in yield. The year of change had started in Luero village. The seeds of Sesbania sesban were then distributed to other farmers. Soil sampling was done on these farms, and the elements most lacking in large quantities were phosphorus, followed by nitrogen.'*

By 1997, farmers in Luero village were already experimenting with *Tithonia diversifolia*. Initially farmers did little with this weed, which commonly grows in this region forming hedgerows. However, they notice that when maize was planted where the weed grows, maize does rather well. But its use was labour intensive. ICRAF research scientists, who had picked it as a soil fertility replenishment weed, encouraged Luero farmers to use it.

*'I came here to learn with the farmers,'* said Dr. Obizoh, when I met him in Luero. He believes that most poor rural people in developing countries are not passive and isolated victims, but hard-working innovators with strong ties to one another. *'They have to be, in order to survive. Researchers should capitalise on these qualities'*.

Dr. Obizoh's words epitomise the shift in tactics that has taken place among researchers over the past few years. A specific project aim is to anchor research and development in the local community and to empower local groups to conduct these activities. Instead of imposing their own ideas on how on-farm trials should be managed, the researchers are tapping the farmers' capacity for experimentation and innovation. Dr. Obizoh told us,

*'It all began in 1996-97 in Luero village under the second phase of the project when about 45 farmers in the village participated in on-farm trials using Sesbania sesban, Crotalaria grahamiana and Tephrosia vogelii as improved fallows. In 1998, the farmers cut the fallows and planted a maize crop. The result was a harvest of spectacular proportions, never before seen in the village. The experience unleashed a flood of enquiries about the new technologies and kindled a redoubled enthusiasm for experimentation throughout the farming community.'*

Before the project commenced in Luero, Mr. Evans Otieno, the Soil Conservation Officer in Yala Division since 1989, was requested by ICRAF to survey and demarcate areas where terraces could be constructed in Luero village. He had done this before, between 1990 and 1991, but farmers never constructed the terraces as recommended. Evans mentioned that farmers had complained it was difficult to construct the terraces. One of the fields he worked on belonged to Martin Onanda. Evans thought most farmers were lazy and some elderly farmers lacked the labour to dig the terraces.

*'The farmers did not see the direct benefit they will get from the terraces, something Evans attributes to ignorance. The benefits of soil conservation are not immediate while people are*

*looking for immediate results. Most farmers are unable to mobilise labour and most of them are old and weak. The youth are not keen on farming. Whatever they get from the farm is not enough to raise the money. The land size also affect adoption. Some farmers see it as a waste of land. They see it as if you are taking a large piece of land from them. 2 metres wide.'*

In the compound of Martin's grandfather are *Mahkamia lutea* trees that were planted by Coen. They are now very big trees. There are also mango trees that were planted a long time ago which are now a meeting point for villagers where they assemble for discussions concerning developments in the village.

Coen van Vliet left in 1995 and Dr. Obizoh took over his work and began work on improved fallow technology. First he planted *Sesbania* on Martin's plot as improved fallow. Then he experimented with green biomass manure transfer using *Tithonia*. Later, through his networks of scientists, he introduced improved fallows using nitrogen fixing shrubs to replenish soil fertility. According to village headman Martin, improved fallow is good for a poor farmer. He gave the history of the various shrubs that were brought in by Dr. Obizoh as follows. *Crotalaria grahamiana* came from Madagascar. It is capable of fixing nitrogen and phosphorus. *Tephrosia vogelii* was brought to Luero village from Yaunde Cameroon. *Tephrosia Candida* a species that is indigenous to the region was found not to be very good in improving soil fertility. In fields where *crotalaria* seeds are planted, they are cut and buried in the soil and one need to add rock phosphate. According to Martin, Luero village started trying these technologies with 45 farmers. The technologies have now spread all the way to Western Province. With Martin's help, ICRAF employed two young men from Luero village to help in collecting data for ICRAF scientists. Martin has planted a lot of *calliandra* in his fields as a fodder crop. The planting of *Tephrosia* and *Crotalaria* started in 1996 by the ICRAF staff under the second phase of SFRRP, that is after CARE Kenya had also started experimenting with *Tithonia diversifolia*. Almost everybody in Luero was planting biomass manure shrubs.

Dr. Obizoh states that beans have not been doing well in the research villages. This he attributes to their continuous growing, which has led to pest accumulation, in particular bean *bruchid*. Reproducing soil fertility in bean fields can help reduce root rot.

#### *The success of SFRRP in Luero village*

A striking feature of Luero and the surrounding villages is their community spirit. Researchers have been able to tap this spirit to disseminate technologies and to spread the message about soil fertility. The community is knit together by a web of local institutions, including church groups, women's groups, youth groups, clan groups and others. These form the building blocks of the technology-transfer effort. With the pilot project's support, Luero formed a special committee responsible for local research and development. Martin

chairs the committee. Its other members come from groups in neighbouring villages. *'We came together because poor productivity is a problem that affects every one,'* Martin says. *'Whenever one of us finds a solution, however small it is, we share it with the others.'*

To start this participatory research process, Martin called a meeting of the whole village. At first, only a few villagers worked with the committee to test innovations. But when they saw the results more and more joined in. Soon everyone in the village was taking part. Luero village is rather homogenous in clan, and as such, leadership is not a big problem.

What was happening in Luero was to be repeated on a larger scale in the broader community. Committee members from other villages were expected to take seeds and information to their own local groups, which became centres for dissemination in their own right. The project team was to study the effectiveness of different kinds of groups. *'Women tend to become the fastest innovators,'* said Nancy Achieng an environmental scientist in Maseno.

*'Their main concern is to make sure the children get fed properly. They are content with any new practice that works, even if it gives only a small gain in production. The men are slower to adopt and are more interested in large production gains that will yield cash income.'*

Since the project began in Luero village, people's lives have improved in three major ways. First, almost everyone in the village is eating better. Secondly, maize yields have risen substantially and continue to climb year by year, and third, most farmers' plots have improved in soil fertility. *'Increasing food production and income is the first long lap on the road out of poverty,'* says Dr. Obizoh.

There are other reasons why Luero has been successful in taking up improved fallow technology. Before becoming a village, Luero was a pasture field. According to headman Martin, pasture fields are normally not very fertile, as they do not benefit from litter fall as do forest areas. Cattle dung offers little fertility and that is taken up by grass. Luero also lies on a slope and experiences serious soil erosion. Martin adds that the village has been neglected in general by researchers and extension officers due to its poor soil fertility.

*'When ICRAF started working in our village, it was the first time we saw scientists addressing our problems seriously. I encouraged my people to welcome them so that we could benefit before other villages. We gave ICRAF scientists all the co-operation they needed and indeed I can say we have benefited from these shrubs. Even the poorest village member at least has tried to grow them.'*

Population increase and reduced cattle numbers to produce manure made Luero farmers see the technologies positively<sup>2</sup>. Besides offering an alternative to

---

<sup>2</sup> Cattle rustling also poses a threat to cattle numbers and thus the potential to produce manure. Cattle rustling is quite common in Luero village. Martin has lost five head of cattle due to

solving the declined soil fertility in the region, the technologies also acted as a source of fuel.

A major driving force to the success of improved fallow technology in Luero was the way researchers and extension workers targeted farmers. Being the first pilot village in Siaya, a lot of resources were made available to secure the success of the project. The first farmers to plant improved fallow shrubs such as *Crotalaria grahamiana* and *Tephrosia vogelii*, harvested a windfall price by selling their seeds to ICRAF. They were paid KSh.1,200.00 for a two-kg tin (*gorogoro*). The seeds were needed for distribution to other farmers in new pilot villages. This led Luero farmers to see growing improved fallow as a source of cash, since there was no cash crop that could render such quick money. Between 1997 and 1999, Luero farmers minted a lot of money from selling their seeds. After 1999, there was no further buying of seeds in Luero village. ICRAF providing a cash market for seeds came in handy as most farmers in Luero associate most of their problems with the tough economic conditions and the fact that they are hardly eligible for credit to engage in 'serious' farming because '*we are poor*'.

ICRAF organised workshops to teach farmers the benefits of these improved fallow technologies in a similar vein, in that according to Kanji, an extension worker,

*'Farmers who attended ICRAF seminars in various places were being paid a per diem. This was the main reason why most farmers were struggling to attend the seminars. The seminars were being organised in hotels where they were being fed and they slept comfortably.'*

Martin being the village headman, and keen to improve himself, forged a very close relationship with ICRAF personnel in order to tap resources. He made sure that his 'fingers' were in all the village organisations in Luero. In this way he succeeded, with the help of ICRAF, to secure an exotic dairy cow from the Kenya-Finland Livestock Development Project<sup>3</sup>. He hijacked the Luero women's group and used it as a springboard to get this animal. When the animal was brought, Martin maintained that it was for the Luero Youth group, of which he is patron. This event caused a rift in the women's group and its consequent split up. Earlier, the Luero farmers' group had won a bicycle from ICRAF because they were the best in the 1997 improved fallow technology establishment in the whole of Western Kenya. Martin also succeeded in convincing the farmers that he could keep the bicycle on their behalf. He later

---

rustling. The first strike was in 1996 and there was a second in 1997. People blame this on Ochung Ambazi, a very rich businessman in the region. '*Ochung en Okebe to kendo en Mugele*' (Ochung is a very rich man but again is a very big thief) remarked one farmer. Martin also believes that the cattle rustlers that terrorise them are on the pay roll of Ochung Ambazi.

<sup>3</sup> This is a bilateral project between Finland and Kenya. The project mainly targets women's groups in their effort to stimulate dairy production.

sold the bicycle and reported to the farmers that it had been stolen. This was the beginning of tensions among farmers at the village level.

Since Martin started dairy farming, he has reduced the size of the plot where he practices improved fallow. Instead he relies on manure from the zero grazing unit. As from the end of 1998, Martin has been practising semi zero grazing. He keeps a Friesian breed, an Ayrshire and a local African Zebu breed. He told us that, '*when you have dairy cows in milk, it is easy to eat.*'

Given that he generates excess manure from the unit, he has given 42 wheelbarrows of manure free to other farmers. 'Because I got my cows through the project, I would also like to help my neighbours for free. I want to live with them in harmony.' This way Martin tries to quell the rifts that exist between him and other village members.

The power struggles among villagers in Luero to tap the resources that came with the project was very evident and known to outsiders. The problems were triggered by the way the project implementers targeted the farmers whom they chose to carry out on-farm research. The first farmers targeted were issued with resources such as rock phosphate, seeds for the shrubs, fertilisers, as well as being paid to work on these plots and guard them to ensure their success. And at the end, after weighing the crop harvest from the plots, they were left with the yields. Those who attended the seminars organised by the project, stayed in hotels and at the end of the seminar were paid a per diem for attending. The first farmers to harvest the seeds from the improved fallow shrubs sold them to ICRAF at a windfall price. These benefits brewed jealousy and rivalry among village members and at a certain moment it became a social problem as close relatives were now witch hunting one another. I will illustrate this with the case below.

*Zedekia Ooko Munyore: a successful adopter who lost out*

Zedekia is a farmer from Luero village. Most people address him by his nickname Zedi. He is farming on a plot he inherited from his father (Figure 8.1). The plot is about three acres according to Zedi, though my estimation puts it at one acre only. As yet, he has no title deed to this parcel of land as he does not have the money to process the title deed. Zedi is married and has four children. He and his wife work the plot together.

Zedi returned to the village in 1995 to fully engage in farming after trying his hands in casual jobs in Nairobi. Since his plot lies in a hilly area and he had not constructed terraces, soil erosion was massive resulting in very low yields. In 1996, ICRAF introduced *Crotalaria grahamiana* and *Tephrosia vogelii*. His entire plot was taken by ICRAF for on-farm trials with these shrubs, including *Tithonia*. When the biomass plants were ready, Zedi was instructed by Dr. Obizoh, who was carrying out the on-farm research on Zedi's plot, to harvest

the seeds. Zedi harvested seven *gorogoro*, (two-kg tins) which he sold to ICRAF, which was then still purchasing seeds at a rate of KSh.1,200.00 per *gorogoro*. Zedi got KSh.8,400.00 from his harvest. He also got fuel wood from the stakes of these weeds. This was his first trial. He used this money to buy a radio cassette so he could listen to the news and music with his family. This made most farmers join the project, as they saw that Zedi was benefiting from the project by selling the seeds.

The leaves of these shrubs are supposed to be returned to the soil to use as biomass and the wood as fuel. However Zedi, and most farmers like him in Luero, did not see it this way. Instead they thought they could best get money from the weeds from ICRAF, and soil fertility improvement was just a secondary benefit. They could use the money to start their own businesses. Zedi started dreaming of big projects and wanted to construct a bigger house.

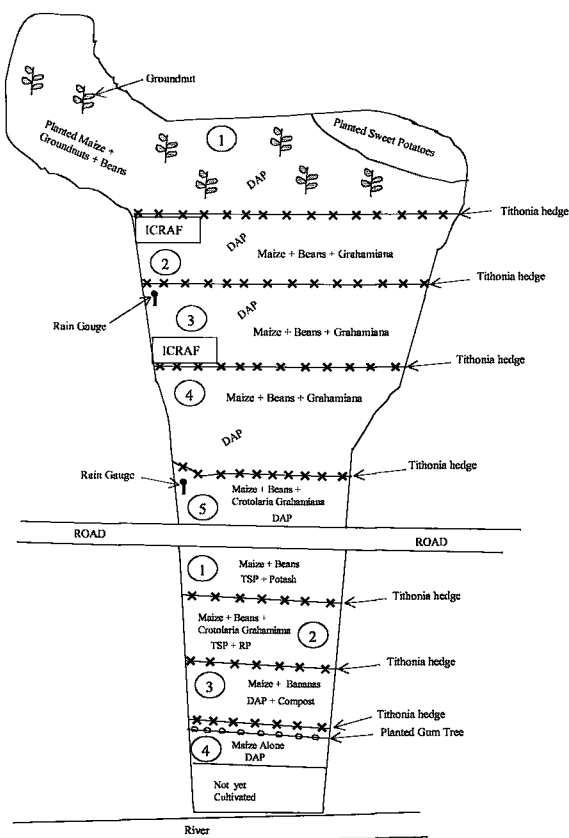
He engaged in serious farming as he says in 1997 by planting one acre. That year he had the largest improved fallow plot in Luero village. He was awarded the first prize of being the best farmer on World Food Day in Siaya district that year.

Zedi is one of the pioneer farmers to start experimenting with improved fallow shrubs. Before these experiments, Zedi obtained only three (90 kg) bags of maize from his one-acre plot. After applying biomass manure on that plot, he harvested nine such bags in 1997. Since Zedi does not have livestock, he opted to plant *Tithonia* as internal boundaries on his farm. He planted the *Tithonia* on ridges, which then act as soil conservation measures on his farms. When he harvests them, he incorporates them as green biomass manure. According to Zedi, stealing is a social problem in his village.

*'We can't keep cattle because people from Western province come and steal from us. Cattle rustling is on the increase in our village. This causes a lack of manure for planting on our plots. So we have turned to green biomass manure as a source of nutrients for regenerating soil fertility in this region. We believe that with improved productivity on the farm, theft will be reduced in the village, as each household will have plenty of food. But because the land is poor, social problems are on the increase. Erosion is a big menace as it washes away fertilisers.'*

Due to the effect of *El Nino* in the second rainy season of 1997, the agro-forestry shrubs bloomed and smothered other weeds. This led to a second problem, caterpillars of the night flying moth-attacking *crotalaria*. The pesticides ICRAF provided were not really effective. Early March 1998, ICRAF came and cleared plots within the *tephrosia* field. They then subdivided the main plots into subplots measuring 10m x 10m. They brought Triple Super Phosphate (TSP) and Urea fertilisers. The TSP was used in some plots. Before doing this, the *tephrosia* seeds were harvested. Zedi's field, which was now subdivided into small plots, was being used for on-farm trials by ICRAF researchers. The inputs

were provided free and they also employed the people that were broadcasting the inputs.



**Figure 8.1: The layout of Zedi's field in 1998 Long Rains**

Zedi hired six people to harvest the plant seeds. He took the seeds to Maseno. In total he received KSh.17,000.00 on his second delivery of seeds. He could not say how many gorogoros this was. Now the rate was reduced to KSh.600.00 per gorogoro. From my calculations he must have harvested about 28 gorogoros.

*'I had four plots after the road downstream. In the first plot I used TSP and potash, in the second I used TSP + RP and Urea as a top dressing, in the third plot I planted using DAP and compost and in the fourth I used DAP alone. In these plots I planted hybrid maize intercropped with beans. A field day was then organised on my farm. After the field day, the majority of*

*farmers in Luero decided to use local maize on their plots with improved fallow. Only a few took up hybrid maize. These few later returned to local maize. The main reason for the low uptake of hybrid is the uncertainty of the rainfall, and most farmers did not want to gamble lest they loose out completely.'*

However, Zedi maintains that to have high yields throughout you need to continue with improved fallow every long rainy season after weeding. *'Otherwise the fertility goes down very fast. The litter from these shrubs does not stay in the soil for long.'* The fallow areas always need to have the shrubs. *Tithonia* hedges are harvested almost after fallowing.

Zedi was the best in adopting these technologies. This plunged him, however, into problems with his paternal cousin, Komo Kajole, who was quite influential and popular with ICRAF personnel and he wanted everything centred on him. By becoming the best farmer in the methods in the region, Zedi was awarded a certificate of merit in 1997. This coincided with the year of presidential elections of 1997, and anybody could be framed as anti-government.

Zedi claimed that his cousin was not really happy with his good performance and that Komo, who was already influential in the village as he was the campaign agent of the ruling party, framed him as a cattle rustler. The police arrested him and he was grilled for many days while on remand. Jacob Oywa Yuke, his neighbour and distant paternal uncle, later bailed him out. Zedi returned from prison very sick.

According to Zedi, the police officer in charge of criminal investigation admitted to him later how his cousin had framed him so that he could be arrested and killed in custody under police torture. He was released on peace bond. Oywa Yuke took his title deed and pensions pay slip as security to the court. Zedi was then ordered to report to court every month in Siaya town for three years. He was spending KSh.200.00 every month on transport to and from Siaya. In May 1998, after the transfer of the Magistrate who was handling his case, the new magistrate acquitted them of the crime and freed them.

Most farmers have a feeling that the approach used by ICRAF to target individuals to work with is the root cause of problems to people like Zedi and of the envy that is producing rifts among community members who became successful farmers after adopting SFRRP technologies.

The relation between Zedi and Komo worsened when Okoyo, the ICRAF extension officer, made the mistake of taking him for a seminar in Busia and leaving Komo out. Zedi told me that this was another reason why Komo organised his arrest. The extension worker learnt from his mistake and discussed it with the assistant Chief. Komo later tried pleading with Zedi that there were no differences between them. He also wanted to plead with Dr. Obizoh that there was no grudge between him and Zedi. However, Dr. Obizoh had been informed of the tensions that existed between the two cousins. Zedi



was advised by family members to withdraw from using the new technology in order to quell the tensions between him and his cousin. That is how he dropped out of farming and started a small business of fish mongering. The money to start this business came from his close relatives. *'My cousin then found it easy because he felt I had been competing with him and offering him a serious challenge.'*

### **Agro-forestry innovations: a solution for women farmers?**

In my interviews with women farmers in Luero village, I asked them their reasons for adoption or non-adoption of improved fallow technologies. About a third of the women interviewed mentioned that they did not have sufficient knowledge of improved fallow technology. Other issues included women's lack of access to land, inability to mobilise sufficient labour and knowledge of how and where to plant them, and family life cycle. Younger women tended to be tied down by caring for young children and as such are unable to find time to attend meetings and seminars where such technologies are taught and their use demonstrated. Older women complained mostly of poor health and also the time the trees and shrubs take to mature and release the biomass. They were not just keen to wait. More common, however, were shortage of land and labour constraints, where agricultural intensity and population density are high. Where hedges were not frequently pruned, some farmers noted that shading of companion crops resulted in reduced crop yields. Some farmers who had tried hedgerow inter-cropping before said that the trees were taking up 'more room than the crops themselves' and/or were shading them out, so they decided to uproot them. As such they were not willing to grow other trees or shrubs. In addition, many women reported problems with pests such as caterpillars that feed on the leaves of *crotalaria*. These caterpillars they say scare them and make some of them hysterical. They lack money to buy pesticide to kill them. This resulted in a substantial decrease in biomass production, which caused women farmers to want to uproot the trees. Based on all these constraints that women farmers had with this agro-forestry technology, they were not really keen to adopt the improved fallow technology immediately when it was started. However, ICRAF's on-farm trials with improved fallows of *Sesbania sesban*, *Crotalaria grahamiana* and *Tephrosia vogelii* are now being accepted by women. They now have a very positive feeling about improved fallow.

#### *Reasons for adopting improved fallow by women farmers*

The main reasons why women take up SFRRP technologies are, reduced soil fertility on their plots, reduced livestock numbers leading to insufficient manure, lack of money to buy inorganic fertilisers, the seeds from these technologies when sold to ICRAF generated lucrative income, the improved

fallow trees and shrubs controlled problematic weeds like couch grass and witch weed (*Striga* spp.).

Mama Maria Ambajo of Luero village is a widow. Before she started using these technologies, she had very low yields from her crops. The input she lacked most on her farm was manure. She also lacked money to buy fertiliser. She had no livestock at the time of the interview. She told me she had two cows that had been slaughtered for her husband's funeral. The poultry she had were wiped out by Newcastle disease and she is waiting for the germs of the epidemic to die down before she starts buying birds again. She is relying mainly on compost manure. She will go for farmyard manure if she can get cattle. She would also like a cow so she could earn money from the milk and also improve the nutrition status of her children with it.

When *Tithonia* was first brought by CARE-Kenya, Maria did not hesitate to take it up, as that was the option available at the time. Later ICRAF brought also improved fallow, which she also did not hesitate to take. '*They are good,*' she says. She had earlier planted *calliandra* brought in by Coen van Vliet.

*'When I started using Tithonia, I used it mainly on my kitchen garden and saw how the kale performed. The leaves were dark green and they were also big. When ICRAF brought rock phosphate to use with Tithonia, the soil fertility on my plot improved. In a plot where I used to get six bags (90kg bag of shelled maize) I got nine after using Tithonia and RP in 1997. In 1998 after removing the improved Crotalaria fallow combined with Tithonia and rock phosphate, I got eleven bags of maize. This was the beginning of the end of food shortages in my house. My bean yield had gone up from one and a half to five bags.'*

Maria says the land where the weeds have been planted is light and easy to work.

*'These shrubs have increased the fertility of the soil. I have used inorganic fertilisers in farming before, but rock phosphate and Tithonia give better results every successive cropping seasons. They clear weeds like couch grass and striga weeds and improve soil workability. Inorganic fertilisers dry up the soil and must be used always once you start it or you get no yield at all..*

She can tell the soil's fertility status by looking at the crop's health, the yields and the colour of her soil. She learnt this as a young girl working on the farm with her parents. However, she thought rock phosphate alone did not make much improvement. RP must be mixed with organic manure or *Tithonia* or applied where the leaves of the shrubs have fallen. She also thinks that the shrubs alone, without adding fertiliser or rock phosphate, do not result in very high yields.

*'If the shrubs are used alone, then you must plant them every long rainy season otherwise you go back to where you were before using them after the third season. They don't stay in the soil for long like farmyard manure does'.*

Another major reason she took up SFRRP technologies was the handsome pay they got from selling their seeds to ICRAF. Maria states the first ten kg (five

gorogoros) she sold to ICRAF earned her KSh.6,000.00, which she used to settle the hospital bill for her late husband. Because of the money for the seed, almost everybody took up improved fallow technology. There were so many seeds that their prices started to fall. From KShs 1,200.00/gorogoro to 1,000.00/gorogoro and to 600.00/gorogoro by 1998, then to 200.00/gorogoro and finally to 100.00 per gorogoro by 1999, after which ICRAF stopped purchasing the seeds from Luero farmers.

Furthermore, Maria, and other women like her of the same opinion, often mentioned during interviews that even if fertiliser prices dropped by 50%, they would still not be able to afford to buy it. And even were it cheaper, they would continue to plant improved fallow, because the benefits of the trees lasted more than one year, and whereas fertiliser depleted the soil, fallow improved it. Even small amounts for cheap fertiliser was hard to come by she said and it was a risky and unreliable way to improve crop yields. She said *'We never know from one year to the next if we'll be able to find fertiliser in the market, or if it will be affordable.'* She says even rich farmers use improved fallow even when they can afford to buy fertiliser. According to her, this means that improved fallow must be good.

Alice Ambajo, married to Maria Ambajo's younger brother-in-law, netted KSh. 21,000.00 from selling her seeds to ICRAF. She used the money to buy two heifers and bullock for KSh.5,000.00 each. Alice's plot has been cultivated continuously, had lost fertility, and was producing very low yields. Though her husband sometimes used to buy inorganic fertilisers it did not improve much as they were not using the fertiliser frequently. She also joined the SFRRP project immediately it started. Having been exposed to various SFRRP technologies, she decided to adopt them. Together with her husband she planted *Crotalaria grahamiana* and *Tephrosia vogelii* seeds from ICRAF on their plot of about one acre during the short rains of 1997. Since ICRAF wanted seeds for fallow crops she left them to seed. This she harvested and realised 17 ½ gorogoros, which she sold to them. She earned KShs 21,000.00. ICRAF was buying at paid KShs1,200.00 per gorogoro at the time. When she cut them finally and planted maize and beans on the fallow her yield of maize rose from three to six sacks (each weighing 90kg). She says ICRAF became popular in the village because of the sale of fallow crop seeds at a good price.

*'I almost stopped planting maize and beans when I realised these seeds brought a better income, which I could use to purchase food crops from other farmers. In fact many people felt they would do that. Now some farmers are discouraged. They have the seeds but ICRAF no longer buys them. This has made their technology unpopular again because people saw it as a source of income. Now many people have cut down the fallow crops and have said that they will not plant them again. Though the fallows improve soil fertility people seemed more interested in the income from the seeds. Yet I blame ICRAF for this. If they had first come and introduced the fallow crops without buying the seeds I'm sure people would have planted it just for soil*

*improvement, now that they don't get the money they seem to have forgotten that it was actually meant to improve the soil's fertility.'*

On the whole Alice is of the opinion that SFRRP technologies are good but that the entry point has created some rifts in the community. This is because ICRAF staff put a lot of trust in some people. This had made some people to suspect that the leaders are usually paid something, creating jealousy and it made people stay away from ICRAF meetings. In addition, ICRAF agents in the village created a village committee to handle farmers' seeds. Alice was convinced that they formed this committee mainly to siphon off farmers' money from the seeds they harvested. *'At one point we had to part with KSh. 100.00 for every gorogoro of seeds we sold to ICRAF. We were not told what this money was for'.*

According to Alice, a point was also reached when some villagers sent their children to steal people's seeds at night. This created tension until a delegation was even sent to the ICRAF office in Maseno. This makes her feel that seed selling was not an appropriate way of entering the village. She has continued to plant the fallow crops for soil fertility improvements. She had used the fallow crops for four years by the end of the research period. She states that there were power problems between the village leader and the researchers because of the dishonesty of some village members. Committee members and other villagers could get up to eight bags of RP and refuse to distribute them to farmers that deserved them. ICRAF decided then to concentrate its efforts in Nyabeda village in Northern Siaya. Alice adds that because of corruption, rock phosphate was taken to another village.

Abigail Buyu, also a farmer in Luero, hails ICRAF for the improved yields she raises on her farm. She says

*'Jo Maseno nyisowa dongruok' (people from Maseno are showing us how to develop). They have taught us how to manage our farms and how to improve soil fertility using Tithonia. I have also planted and used fallow crops. I use Tephrosia vogelii and Crotalaria grahamiana and others as green manure'.*

Buyu is conversant with the technologies and manages to include fallow crops in the piece of land available to her. She has used SFRRP technologies for three years (since 1998). She first heard of them from the home of the 'ICRAF agent' where ICRAF staff had organised a village-based demonstration and training. It was in this home that ICRAF brought *Tithonia* cuttings for their registered farmers to take and plant. She also took some cuttings and planted them on her farm. From then on she has regularly attended ICRAF meetings, getting prompt information from the village agents about the meeting schedules. Though Buyu says that many people have stopped planting the fallow crops because ICRAF

no longer buys the seeds from the farmers, she has continued to plant them but on a smaller portion of her land.

Buyu appreciates the ICRAF technologies as they term them, though she says it is not easy to follow the instructions to the letter. Like many other farmers she is happy with her increased farm yields. She regularly attends meetings called by ICRAF agents because she gets the information on time from them. She says that even the rich people in the village attend ICRAF meetings and training though they do not apply the technologies. They still depend on farm yard manure and inorganic fertilisers because they can afford to buy. Thus they feel that the technologies taught by ICRAF are for the poor. She says:

*'the rich people use farmyard manure on their own farms while they use the fertilisers on leased land which they do not care about even when the land becomes unproductive due to continuous use.'*

#### *Constraints to the adoption of SFRRP technology by women farmers*

Luero women claim that the biggest constraint is their inability to mobilise and hire labour. Leonida Okoth who is the chairlady of the Luero women's group states that she does not use the ICRAF soil fertility technologies because she is unable to attend their meetings due to her busy schedule. She cannot do farming, domestic chores, business, care for her sick child from whom she cannot be away long, and still be able to attend the ICRAF meetings where the SFRRP technologies are disseminated. Thus she does not use any of them. She uses manure from her cattle pen instead.

*'I have always used farmyard manure, well before these new SFRRP technologies were taught in our village. When I have money, I buy a little inorganic fertilisers that I use to complement the farmyard manure.'*

However, her co-wife, Achieng Mumbi, uses SFRRP technologies and she sees her get good yields. But, as she says, *'these technology are labour intensive and financially demanding and I don't have either. It is also not easy to implement them on a large piece of land'* and she also adds *'I do not have the time.'*

Another factor that can complicate the adoption of SFRRP technologies in a village is strained family relations. Leonida's brother-in-law is the ICRAF agent in Luero village but he does not share information with her about ICRAF technologies when they meet casually. *'He never tells me when there are meetings, neither does he give me any advice because I am not able to attend the ICRAF meetings. Besides these I don't have a good relationship with him.'* This could have had a bearing towards her indifference to the SFRRP technologies as disseminated by ICRAF. In any case she is of the opinion that all ICRAF activities and communication in the village are all centred on this agent in whom she feels she has no faith. She feels it would be better if there were more than one ICRAF agent so that when a person has a difference with one, they can go to another.

Family life cycle and poor health was also mentioned as a major constraining factor to the adoption of improved fallow technologies. For example, Achieng Mumbe says she agrees that the new technologies taught by ICRAF are good but many young women find difficulty in adopting them because they cannot regularly attend seminars and other workshops organised since often when they are invited they are mistaken to be friends of the male ICRAF staff. This has resulted in gossip so their husbands do not allow them to attend the workshops. Another issue is that it is mostly women in Luero who work the farms but men are the decision makers, and if they decide against the use of the fallows then the women cannot adopt them even when they want to. Yet still women's household chores are also too many to allow for enough time to implement labour demanding technologies. Those who do are those who can manage to hire extra labour or do so on a very limited piece of land (less than half an acre).

Achieng mostly hires labour but she also goes with them to work because otherwise they do a shoddy job when left on their own. Her husband supplies the money for the entire farm operations and purchase of inputs. *'It is not easy to combine farm work with domestic chores that include caring for school-going children and a suckling baby. Otherwise the farm work will not be successful,'* she says. She added that if her husband should stop sending money for farm work she would still do it, but on a more limited basis.

For elderly women like Dorcus Kidha, the going is even tougher. Apart from having difficulties in mobilising labour, they are weak and in poor health. They do not understand exactly what illness they have, but the truth is that they suffer from general malaise.

When I asked her why she did not continue with the improved fallow and green manuring despite the fact that their use resulted into good yields, she said that she could not cope with the hard work involved.

*'I don't have time to pick enough akech (Tithonia). Besides it is hard work and I am old and tired. This kind of work I leave to my daughter-in-law. She uses the new technologies and the ICRAF people usually come to visit her. They have also planted on one of her plots. Thus she is better able to explain the new technologies. But she fears the caterpillars that appear in the crotalaria plots. It has very large scary caterpillars, which make it very difficult for many people to work on it. Even so, if the money for seeds was guaranteed, I would plant again because I would then be able to get money to buy food.'*

Dorcus had two acres of land but had to share it with her two sons. She is left with about half an acre of land. Because she has such a small piece of land, she has leased plots from her neighbours.

*'I do not have land large enough to leave as fallow during short rainy season. To plant the fallow crops one requires a large piece of land. For me it is not possible and I have to plant in the two seasons to get something to feed my children and grandchildren. To be on the safe side,*

*I also have to plant sweet potatoes and cassava to take care of the months of February to March when our stores are empty.'*

Because of the sickness she did not harvest most of the *crotalaria* and *tephrosia* seeds in the farm. The little she harvested she sold to ICRAF at KShs 800.00, which she really appreciated. She knew those who had first sold the seeds got a lot of money and that prices had gone down.

*'the work of picking and preparing the seeds is quite difficult but when you get the money then you feel good, but you see now these people do not need these seeds any more so I stopped planting them. I even have some of the seeds here with me. I do not know, maybe one day I will plant them or if ICRAF calls for more seeds, I will sell to them'.*

Dorcus would have liked to continue with SFRRP technologies but her age will not allow it. She is old and weak and has health problems. Despite this, she tries something at least. According to her these technologies are an option to those who cannot generate sufficient farmyard manure.

### **An analysis of actor's perceptions of SFRRP technologies**

#### *A dairy farmer's perception*

Joseph Ogwanjo is a dairy farmer in Nyamninia village. He argues that nothing shows that the lives of the farmers who took these technologies have improved. According to him *'improved fallow technology is just a passing cloud,'* and he challenged his son Kanji to prove him wrong. Ogwanjo, who is a zero-grazing dairy farmer, believes that the most practical way to improve soil fertility in Siaya District is to reconnect livestock-crop production that had been lost by most farmers. He argues that manure from livestock is more useful than the improved fallow technology. *'This will just be like any other project that was started by the government and failed,'* he adds.

Ogwanjo says that these technologies are purely for the poor. Rock phosphate is only good for demonstration. It is also not available in the local market and he wonders if they will be available anywhere if ICRAF leaves. *'Since it is cheap, the rich will grab it before it reaches Kisumu (some 40km from Luero).'* He adds that the species can help very little. With livestock he gets a continuous flow of manure.

*'People are getting tired of the technology. ICRAF has now shifted to Nyabeda village. That is where their activities are concentrated. If you take on these technologies, then it means you have no land for planting sweet potatoes and cassava which are security crops during times of grain scarcity.'*

#### *MOALD Extension Worker's perception*

In the initial stages of the project, extension officers from the Ministry of Agriculture and Livestock Development (MOALD) were quite enthusiastic

about it. But as time went by, they became somewhat pessimistic about the success of this project. *'We do not see any possibility of the success of the shrubs in the farmers' fields after sometime. This will be just like any other intervention tried out in this area,'* said Kanji, an extension worker with MOALD. To prove his point, he gave as an example, Madiri village, which neighbours Luero. Farmers in Madiri did not take up improved fallow because, according to them, ICRAF/KEFRI/KARI personnel had ignored them for the four years they were active in their region. One farmer from Madiri mentioned that they refused to attend ICRAF/KEFRI/KARI workshops and field days as second class farmers. For them to take on the technology, they expected to receive the same degree of attention as farmers in Luero. In my interview with Okoyo, the ICRAF extension agent, I discussed with him the difficulties of diffusing their technology to other villages if the neighbouring village was not taking it up. His reply was: *'Even Jesus was rejected in his own village. These technologies are not meant for everybody.'*

Okoyo argued that it is important to tailor soil fertility technologies to people with different motivations and constraints. He explains that,

*'people in a hurry need something which works quickly like fertiliser or manure; people willing to wait for one to two years can try improved fallows; households with more access to labour can try manure, improved fallows, and green biomass manures, whereas households with more access to cash should learn how to use fertiliser efficiently; households with access to manure should learn how to use it and market it; farmers with limited land need to use manure or fertiliser, etc.'*

However according to Kanji, ICRAF has a lot of money, which is being misused. So-called on-farm research is just curiosity research, which might not bring any benefit. *'We were used and then dumped, yet we are the people who matter on the ground',* he said. Extension workers are not happy with ICRAF/KEFRI/KARI personnel for having used them to initiate the project and later then left them hanging. Instead, they employed unqualified people to do the extension work and paid them handsomely. Kanji cites the case of Okoyo who poses as an extension worker yet he is not even qualified in that field. *'In any case, he is an ex-forces man. Expecting a big change'.* Kanji further argues that

*'The whole of Luero village took up improved fallow technology. Farmers are seriously disappointed. Sustainability of biomass is highly questionable. ICRAF is a closed organisation. The basis of their activities is not known. They had money to spend and were directed to a very poor village. Payment in terms of output should have been done through a government institution, such as the Ministry of Agriculture, Livestock Development and Marketing. Moreover, we do not get feed back from ICRAF even though they mention us as collaborators. The outcome of their project is not really demonstrated. The continuity of the whole project after ICRAF has left is questionable. Rock phosphate that was advocated by ICRAF staff is really difficult to implement since large quantities are required for it to work properly. Funds for purchasing it from Mijingu in Tanzania, and for processing and packaging are just not*



*there. Processing, packaging and wholesale /retailing is still not very feasible. Particularly when the project comes to an end. Rock phosphate is a little bit tricky because the amount of application was not clearly stated. The general consensus is that our soils lack nitrogen and phosphorus. CARE-Kenya's method of restoring nitrogen in the soil using Tithonia is quite labour intensive. When ICRAF came to Luero village, they came with farm inputs including food. They targeted farmers in the markets and also during the field days, and they used to feed farmers. This kind of intervention has led to power struggles in Luero village. ICRAF agents in the village will always a mass a lot of the rock phosphate and they will not allow others that do not belong to their camp to get any'.*

Kanji tells how this led to power struggles and jealousy among farmers. For him, this was the starting point of the failure of ICRAF in Luero because it resulted in a lot of infighting for access to inputs brought by ICRAF.

*An international research scientist's perception*

In this section, I will give the views of a man who has devoted himself relentlessly to providing food for the hungry: Dr. Norman Borlaug. He was awarded the Nobel Peace Prize in 1970 for his untiring efforts to feed the hungry of the world. He shared his views with me on the campaign for organically grown foods using technologies such as those used in Luero. Because of the SFRRP so many dignitaries - some from the government and others from international organisations - visit Luero village, all of them expressing optimism for these technologies. However Dr. Borlaug, whom I bumped into in Luero by chance, gives a somewhat different view of these technologies. When I met him, at first I thought he was a tourist, since he seemed a little too advanced in age to still be visiting research site on a professional basis. In our discussions all along he thought I was a journalist until I told him what I was actually doing in Luero village at the end of my interview.

At 86, he is probably the oldest active agriculturist still in the field. Flying around the world attending seminars, workshops and giving talks is to him second nature. He told me that out of a year, he spends only three months with his wife. Not that he spends all the 2160 hours with her during those three months, since he also gives lectures at Texas University in the United States, where he is a professor of International Agriculture. For more than 55 years, he has battled against hunger and poverty in developing countries. His approach to development has been characterised by expertise, energy and an overwhelming sense of urgency. He told me that his approach to smallholder agricultural development began in Mexico in 1944, when he was hired to lead a wheat research programme to tackle the nation's food crisis. Then, during the 1960s, he took his high-yielding, disease-resistant 'Mexican' wheat to Asia, which ended famine in India and Pakistan. It is for this that he was awarded the

Nobel Prize. Since 1986, in collaboration with the former US President Jimmy Carter, and the Nippon Foundation of Japan, Borlaug has led a smallholder agricultural development programme in sub-Saharan Africa known as the Sasakawa-Global 2000 (SG 2000) programme.

Agricultural projects of the SG 2000 are operated as joint ventures between two organisations - Sasakawa Africa Association (SAA) and the Global 2000 programme of the Carter Centre in Atlanta, US. He is the president of SAA, which serves as the lead management organisation for the SG 2000 projects in Africa. So what does he think of the current crop of scientists? According to him,

*'latter day scientists confuse the world and build their own prestige without building the food stocks. They say that fertilisers are bad for the soil, not knowing that these are in effect nutrients for the plants. We should not discredit science and technology, for where would we be without science and technology? We should use common sense to make it work.'*

According to Borlaug, if we had tried to produce the 1997 world cereal harvest using the prevailing 1960s technology, we would have needed 1.7 billion hectares of land, instead of the 700 million hectares currently in use today.

*'Where would the additional one billion hectares come from? How many forests would have had to be felled? How many grasslands and hillsides would have had to be ploughed up?'*

He believes that population explosion has had one of the greatest human and ecological impacts of the 20th century.

*'We cannot turn the clock back to the pre-1960's period and re-adopt the so-called organic approaches to crop production which were followed in an earlier day. These lower yielding agricultural systems – albeit relatively stable – can only support three billion people. What would we do with the remaining three billion people? Advances in agricultural productivity have enabled us to avoid human catastrophes of unimaginable dimensions.'*

Africa's farmers, he contends, are eager, willing and able to double and triple their yields. Moreover, with 60 to 80 per cent of the population engaged in farming, productivity-led development will do much to stimulate their economies and reduce poverty, the root cause of food insecurity. Dr Borlaug, who is a senior consultant for the International Maize and Wheat Improvement Centre, fails to comprehend the current backlash against science and technology which is evident in some industrialised countries. *'How quickly humankind becomes detached from soil and agricultural production!'* he wonders.

*'Less than four per cent of the society in these industrialised countries is engaged in agriculture. With low-cost food supplies and urban bias, it is no wonder that consumers do not understand the complexities of re-producing the world food supply each year in its entirety and expanding it, at a minimum for the nearly 100 million born into this world annually.'*

The man, who served as the Rockefeller scientist in charge of wheat improvement under the Co-operative Mexican Agricultural Programme between 1944 and 1960, says that the widespread 'anti-science' campaign being

orchestrated by extremist environmental groups is well-financed and frightening. *'They seem to want to stop the natural forces of evolution in its tracks, and to put our planet in the hands of the privileged well-fed elite.'*

Dr Borlaug, whose high-yielding wheat technology in the mid-1960s sparked the Green Revolution in cereal production in India and Pakistan, asks if African farmers can afford organically-grown food using technologies such as those promoted by SFRRP in Western Kenya, when, in sub-Saharan Africa, getting enough to eat can call on 70 to 80 per cent of a family's human and financial resources. He adds: *'and could they even use this method if they wanted to, especially when there is not enough manure, crop residues and farm power available to do high yield-organic farming?'*

Dr Borlaug, who has served on the US Presidential Commission of World Hunger and the US President's Council of Advisors on Science and Technology, urges Africa's leaders not to close their doors to the future benefits that biotechnology can bring to their nations. They should put their laws and regulatory procedures in order and continue to strive for strong publicly funded agricultural research systems which can provide farmers with continued streams of new technology that can be made available with no royalties or patent charges.

A common conclusion drawn from by Dr. Borlaug's views is that Africa should follow the mineral fertiliser paradigm if it is to restore soil fertility and raise crop production. Given the extraordinary success of the 'Green Revolution' in increasing food production, Dr. Borlaug, and many others in similar positions to him, appear to argue that intensive packages of improved variety and fertiliser should be widely applied as the model for agricultural development and as a means of ensuring household and national food security. Although this may sound appealing, there are, as we have seen in the maize chapters, numerous exceptions and constraints that curtail the adoption of this approach in many developing countries.

Other technological changes that emerge from below, such as green biomass manure based on farmers' own innovations, are not captured by these scientists as alternatives that can help farmers who for various reasons are not in a position to implement Green Revolution packages.

### **Contextualising the second soil fertility paradigm**

The core assumption of the second soil fertility paradigm is that if the improved fallow technologies are successfully adopted, then soil fertility will be improved and farmers will realise higher grain yields. This means that the period in which rural households will be self sufficient in grains will be longer. Dr. Ibrahim Obizoh, ICRAF's principle scientist, suggests that if farmers continue to cultivate improved fallow trees and shrubs, then yields will have to be

increased by 300%. However, if high value crops are introduced, as the project suggests, farmers might be able to generate higher monetary incomes that can cover purchases of food and still leave the household with a surplus for other expenses. From the surplus, they can then buy other food crops such as sweet potatoes and cassava that definitely have to be phased out by the adoption of these technologies, due to the fact that the improved fallow trees and shrubs will have taken the spaces in the plots where these other food crops would be grown. The assumption that the project makes is that these food crops would be available in the region from surplus producing regions whenever required. This, of course, is not always the case since, for various reasons, farmers sometimes go hungry even if they possess money. One day a farmer remarked that during the *gorogoro* famine of 1982-1984 *'we were dying with money in our hands'*. The experience of this awesome period is still in peoples' minds and shapes their current perceptions and agricultural practices. Relying on food purchases does not, therefore, correspond well with the locally shared perception that a good farmer is one who produces food for the family from his/her own fields.

In order to have sufficient organic matter for the biomass transfer in the long rainy season most of the cultivated land must during the short rains be converted to the production of biomass. Therefore it is important to consider whether the increase in yields during the long rains can compensate for the loss of yields in the short rains, and still give an overall increase in yields, and whether farmers are willing to allocate land that is required for the production of biomass. An issue to consider is whether this pattern of land allocation corresponds with the current pattern of two harvests per year which farmers practice in order to minimise the risks of crop failure. If they rely mainly on crop production in the long rainy season, then food security will be seriously jeopardised should the harvest fail. The question is whether or not farmers are willing to take such a risk.

Since the improved fallow shrubs are normally produced during the short rains, the area cultivated during this period is reduced, and consequently the labour input. This is because farmers will be waiting for the shrubs to develop to the required stage for them to have accumulated enough biomass. This normally corresponds to the months of January and February. Conversely labour demands will increase in other periods of the year. Farmers argue that the adoption of the project's technologies will increase the demand for labour in January and February when the plots are prepared for cultivation before the long rains set in. This is one of the busiest periods of the year when some farmers already struggle to find additional labour. They have to prepare the plot, sow, harvest cassava if any and sometimes also sweet potatoes, apply manure, and in addition they will have to fell, transfer, and incorporate the

biomass into the soil. With the increased demand for labour, this particular period can easily become a bottleneck preventing some farmers from adopting the project's technologies. It is especially farmers without sufficient capital to hire in labour who will experience labour shortage during the peak period of the long rainy season. This would indicate that it is the poorest farmers who are likely to have difficulties in adopting the SFRRP technologies. If, on the other hand, the innovations could generate substantial amounts of cash from the production of high value crops, the dependency on generating cash from off-farm employment could be reduced, and the labour could be re-allocated to on-farm activities. High value cash crops can only be introduced if there is a ready market for them and my survey shows that sometimes farmers sell their produce like kale at throw away prices due to over production when most farmers produce the same commodity at the same time. Thus unless there is a proper market where farmers can sell their produce at a profit, they might not be enthusiastic about growing high value food crops for cash. However, if SFRRP succeeds in the creation of a market, then farmers, in their own words, are willing to grow high value crops in exchange for cash.

Another precondition for participating in the project is that the farmer has already where necessary constructed soil conservation structures. But as we have seen, farmers have their own reasons for being unwilling to construct these structures in their fields. Moreover, only those capable of mobilising labour can in effect build and maintain them. Therefore, if these structures are used as criteria for participation in SFRRP, many poor farmers are likely to be excluded. Indeed this is what is occurring in the villages where I carried out my field work and which was a source of envy as the project targeted only a particular group of farmers.

Dissemination of knowledge through project personnel and extension officers from the MOALD is generally perceived as essential. My findings show that extension services are only received by a very few farmers and, in particular, those who are able to make sufficient use of the extension advice. It is the better off farmers who benefited most from this service. Poor farmers meet extension workers in the fields of the rich farmers, but what little information they obtain, they can not implement in their own fields due to the lack of time and resources. As one of the aims of the project is to break the poverty circle, it is important that the project considers how the poor can be targeted. This is all the more so since the project personnel undercut the extension agents from MOALD, the sustainability of this technology is questionable when ICRAF/KEFRI/KARI leave.

## Conclusion

This chapter has focused mainly on the most recent technologies aimed at improving soil fertility emerging from research - the so-called second soil fertility paradigm - and on technology developed by the farmers themselves. These technologies are aimed at re-establishing and strengthening tree-soil-crop interactions that has been lost over time due to deforestation emanating from increased population and intensive forms of land use.

Recent farmer technologies developed together with research institutes focus on improved fallow and green manure with leguminous trees and shrubs, such as improved fallow with selected species of leguminous shrubs and herbs, especially *Sesbania sesban*, *Crotalaria grahamiana*, and *Tephrosia vogelii*. They represent what we have called in this book as the niche. They are technological changes from within, which operate independently from the predominant fertiliser regime. They perform best on soils that are deficient in both nitrogen and phosphorus.

Preliminary results of on-farm trials using these species suggest that crop yields can be improved considerably. Biomass transfer, a technological 'change from below', is the farmers own innovation and is another potential technology for restoring soil fertility and improving crop yield. Biomass can be obtained from *Tithonia diversifolia*, found in hedges on farmers' fields in the area. On-farm research confirmed observations by farmers that crops grown next to or with an application of the prunings of *Tithonia* as green manure have a higher yield. However, the technique is labour intensive. The quantity of biomass needed can be reduced when combining it with inorganic fertiliser. Crop yields increase still further when rock phosphate and farmyard manure are added. Another way of making biomass transfer more economically viable is by using it mainly for cultivating high value crops such as vegetables. This is one of the aims of SFRRP i.e. to improve yields for food security and farmer incomes from cash crops.

The single most important incentive for farmers to try improved fallows is the condition of their soil. But even farmers with moderately good soils see the benefits of improved fallows as a way of saving money on inorganic fertiliser, or to reduce the risks associated with its use. Farmers with adequate access to farmyard manure and fertiliser use improved fallow only minimally.

My findings show that labour shortage is the major constraint for adopting the SFRRP. However, I believe that if a big enough market was created for cash crops, farmers would dedicate the time given at present to off-farm employment to farming activities, which would alleviate some of the labour shortage. Other constraints were insufficient land to use the technology, lack of time, family life cycle, gender disparities, and strength (again, mostly for older

farmers). In the target villages knowledge and seeds were not constraints though they are likely to be so in areas where extension efforts have not been as great.

For women, my research concludes that a significant number of women farmers have insufficient land to grow enough food, regardless of technology or fertiliser availability and opportunities need to be created to improve the returns on their resources in a broad context, including cash cropping, non-farm micro-enterprises, and agricultural labour. Only when women farmers have a cash income will they have a sustainable way of buying or repaying loans for fertiliser inputs of organic or inorganic origin for their food crops.

The success of SFRRP in the pilot villages is the result of over five years of intensive on-farm research and dissemination efforts. It takes time for lessons to sink in and technologies to take off. There are still farmers in the research villages considering testing improved fallows in the future, and former testers who expect to plant again when their circumstances improve. Farmers generally recognise the appropriateness of the technology as the resources for it are all available in their environment or can be generated by themselves through planting the seeds.

Unlike green revolution projects that come in the form of a package and are highly linked to the markets, SFRRP leaves farmers to experiment with them in anyway they like and it responds to the farmers' abilities and desires to find alternatives to solve elements of the agrarian crisis by looking at their own natural and social environment. SFRRP is assisting farmers to distance from markets and this works particularly well for resource poor farmers and those who are suspicious of fertilisers. That fertiliser spoils the soil is a notion that is quite wide-spread in the region and requires serious attention and can only be understood if local knowledge is taken seriously. It makes sense for research to support farmers in their own efforts to restore soil fertility through the use of their own and locally defined resources. It makes no sense for extension workers to simply say '*here is how you do it, here are the seeds, here are the benefits and now go*'. Improved fallows are not like improved varieties, which are often of crops farmers are used to planting. People have no formal experience of using trees or crops to improve their soil, although in some senses they have been doing it for years.

Although there is much enthusiasm for improved fallows as a basic way to improve soil fertility in the tropics, it is to be expected that farmers will not adopt the technology as designed and cover large portions of their farms with trees and shrubs. Moreover, there remain some practical constraints to its adoption per se, labour being the most serious. As much as SFRRP technologies offer alternative and complimentary options, whether they will continue to be used after the project has terminated in the region is yet to be seen. In this

respect, the second soil fertility paradigm needs further exploration, and needs not only to attempt to resolve the labour bottleneck issue, but also seriously engineer a dialogue with local farmers about their claims and problems in adopting its practice and concerning soil fertility reproduction in general.

For the time being, the claim made by Sanchez (1999) and other experts that agro-forestry technologies indeed represent a second soil fertility paradigm remains an issue for debate. This chapter has indicated that agro-forestry 'makes a difference', but clearly also pin pointed critical issues that go beyond the technology *per se*. The context and set of relationships forged to spread such technologies are equally important for the label second soil fertility paradigm. Agro-forestry to be legitimately labelled as an alternative paradigm next to the fertiliser one should pay much more attention to the way in which such technologies are introduced and to the social dynamics triggered off by intervention. The notion of strategic niche management as coined in the introductory chapter may be a way forward.





## **Agrarian development and socio-technical change in Luoland**

### **Introduction**

It is now time to pull together the theoretical threads and to indicate the major findings of this study. I also briefly discuss the responses of government and NGOs to Luo farmers distancing from introduced technological innovations. I conclude with some observations on the future of agricultural and rural development in Luoland.

### **The main argument: a theoretical reflection**

This thesis is theoretically situated in relation to discussions on the dynamics of agricultural development and technological change. While these processes are often depicted as linear, my empirical data for Luoland underline that it is more appropriate to conceptualise development as essentially non-linear. In the introductory chapter this issue is linked theoretically to processes of interlocking, transforming and distancing of actors' projects, and is illustrated empirically by reference to men and women farmers, extension workers and scientists. Agricultural development is thus perceived as many sided, complex and often contradictory in nature. It involves different sets of social forces originating from international, national and local arenas. The interplay of such forces generates specific forms, directions and rhythms of agricultural change (Long and Van der Ploeg, 1988: 37). The notion of social heterogeneity has been coined to capture the idea that different social forms of development, organisation and agricultural practice co-exist. Heterogeneity does not emerge casually and nor can it be engineered (Long, 2001: 39). It is rightly labelled as an important structural feature of agrarian development.

In coming to grips with these processes, the collection of and interpretation of data has focused on issues of knowledge production and exchange, the role of human agency and the cultural repertoires of Luo farmers, extension workers and scientists. These dimensions have been explored through an understanding of the encounters between various bodies of knowledge embraced in two domains of agricultural production: maize varieties and soil fertility aspects. These issues are commonly shared and identified as problematic by the actors involved. However, as the analysis has shown, despite these concerns being shared, this cannot be said of the proposed solutions. It would be rather more accurate here to talk of knowledge conflicts and claims. The encounters

between scientific and local bodies of knowledge - depicted in this thesis with regard to the breeding and selection of maize varieties and on ways of reproducing soil fertility - constitute an important and dynamic force that continuously produces and reproduces heterogeneity. These clashes and frictions between scientific and local knowledge have been treated here as the likely outcome of planned intervention and explored with reference to a recently developed framework for analysing the dynamics of technology development and design in terms of so-called socio-technical regimes (Rip and Kemp, 1998; see also Hebinck 2001). This concept evolved from the work of academics at technical universities in their attempt to understand technological change from a social science perspective. The concept has proven useful in the thesis for ethnographically exploring and linking processes of social and technological change with respect to maize and maize breeding, and soils and soil fertility replenishment. The theoretical and practical advantage of the notion of socio-technical regime is that it proposes a non linear perspective on change and explores the unfolding of divergent technological trajectories over time. Thus, following Hebinck (2001), I describe socio-technical regimes as multiple or heterogeneous, and consider change processes at the level of regimes as initiated 'from above', 'from within' and 'from below'. At this point (see especially Chapters Four, Five and Six) I argue that technological change generated 'from below' may be compared with what Long and van der Ploeg (1994) conceptualise as the 'distancing' of actor projects. Socio-technical change embodied in such projects is strongly embedded in local knowledge, cultural repertoires and institutions. On the other hand, the 'interlocking' of actor projects is associated with those projects that continue to align - for good or bad - with the predominant technological regime of hybrid maize and fertilisation. Thus socio-technical change as captured by the notion of socio-technical regime links culture and the social with artefacts such as hybrid maize and agroforestry technologies.

In a similar manner I have identified distancing at the points of interaction between Luo cultural practices and agriculture. The Siaya landscape is not only undergoing transformation physically but also culturally and socially. As I explain in chapter Two Luo farming practices have evolved from shifting cultivation via fallow-based farming, to permanent agriculture, mainly in response to increasing population pressure and market integration. This pattern of change in the Siaya landscape is consistent with the model developed by the agronomist Ruthenberg (1980), which traces the evolution of farming systems towards permanent upland cultivation in the semi-arid and sub-humid tropics. In line with such transformations, Luo cultural practices such as first sowing (*golo kodhi*) and first harvesting (*dwoko cham*) based on seniority, have remained important elements in shaping agriculture and technological choices despite

modernisation, labour migration and the increasing influence of Christian churches. Such change, as I argue in detail in chapter Three, can only be understood with reference to the gradual changes of Luo kinship relations and the conflicts they evoke.

The usefulness and practical application of notion socio-technical regime is that it allows for an analysis of the underlying technological discourses and practices of the different regimes and technological trajectories. It also helps to identify alternative ways of responding to processes of social, cultural and economic change in societies like the Luo. Taking both the selection and breeding of maize and soil fertility replenishment as cases in point, the 'hybrid and fertiliser school' may still be predominant, but the beacons are slowly being reset, giving rise to the emergence of new or alternative socio-technical regimes. In the domain of soil fertility, we encounter socio-technical regimes that are a mixture of technological changes 'from within' and 'from below'. For example, the open pollinated maize varieties such as the Maseno Double Cobber are, in the socio-technical sense, clearly an example of change 'from within' and the current and increasing emphasis on open pollinated varieties by Lagrotech, CARE-Kenya and KARI research officers echoes the changes that have taken place in technology development since the early days of the Green Revolution, and not only within KARI and other NGO-like networks, but also within CIMMYT world wide (Hebinck, 2001). A different cultural perspective is then emerging that aims to correspond better to locally prevailing conditions. The breeding of OPV's may be similarly characterised as the agro-foresters, as a second maize-breeding paradigm that generates more useful varieties.

Irrespective of whether these examples in the domains of maize and soil fertility are to be understood as change 'from within' or 'from below', a common characteristic is that they are embedded in and stimulated by particular social networks. These networks are built by different kinds of scientists who wish 'to make a difference' by applying the scientific knowledge and skills they command to 'the needs of their people'. The cultural repertoires of Lagrotech or CARE-Kenya breeders differ significantly from those of Borlaug and Harrison. Hence we may talk about an emerging second paradigm in selection and breeding of maize and in soil fertility replenishment. These networks and the second paradigm are in stark contrast to Green Revolution networks. Initiating technology development 'from above' and often still making use of 'extensionist' approaches to introducing innovations to users have proven ineffective in Kenya and Luoland, in particular. Yet what is labelled 'niche' development in the introductory chapter is still often approached with suspicion by agricultural scientists. Claims made by farmers about their maize and soil fertility practices are not well understood (if not to say misunderstood) nor are they seriously investigated. AGRINOVIM scholars

link such niches with hidden novelties that emerge from below and operate independently of the predominant technological regime within the wider socio-technical landscape. Hence, they represent missed opportunities by scientists advocating for technological change 'from above' and 'from within', by failing to acknowledge the advantages of change 'from below'. Such niches can then be seen as a third paradigm. For example, the niche of local maize, described in chapter four and five, constitutes a social field wherein alternative technologies are developed and co-exist with the predominant maize regime. These niches challenge the predominant regime (i.e. they apply pressure 'from below') which is rather static, inert and entrenched.

The different bodies of knowledge associated with the types of technological innovations that have emerged in Luoland over the years underpin the argument of the thesis that processes of social transformation involve knowledge encounters and the co-existence of socio-technical trajectories or regimes. For example, practices based on high yielding varieties of maize, open pollinated varieties of maize and local maize, and fertilisers, agro-forestry and manure all co-exist. This heterogeneity is continuously produced and reproduced, providing (at least theoretically) a breeding ground for continuing experimentation and the enrichment of knowledge. This is happening with the mass selection of maize varieties, and green biomass manure using shrubs such as *Tithonia diversifolia*. These processes resonate with the argument for the co-existing regimes whereby niches challenge the predominant regime. Despite being a largely localised phenomenon, mass selection certainly possesses its own dynamics and definitely has a role to play in resolving problems of food security alongside the use of modern hybrids. Green biomass manure and improved fallow technologies - referred to as the second soil fertility paradigm - also play a role in improving soil fertility alongside the dominant fertiliser regime. At a more abstract level, one can argue that providing their discourse is taken seriously, then the experiences and dynamics of mass selection and breeding of local varieties of maize and of improved fallow technology and green biomass manure will undoubtedly broaden the horizon of technology development. Geels and Kemp (2000, quoted by Hebinck, 2001: 136) refer to this as 'strategic niche management'. Given the discontinuities between these particular niches and the 'modern' regime in Luoland, it would seem that for the time being such strategic management will remain within the localities themselves. It is unlikely to have a widespread impact on agricultural intervention practices.

### **The ethnography of technology: husbanding the land**

Part and parcel of a socio-technical perspective is the necessity of embedding the analysis of technological change in the ways local people, in this case the

Luo, organise their daily lives, particularly in regard to the ways they tend or husband the land. To understand technological change and to come to grips with the choices local people make with regard to which maize varieties to plant and how to reproduce soil fertility, it is imperative to embark on an analysis of Luo culture and an ethnography of technology. Such an entry point was upmost in my mind when collecting, interpreting and analysing case study data and farmer narratives. Recently, Terry Eagleton's book on *The Idea of Culture* (2000, Blackwell, Oxford) was brought to my attention and has strengthened my belief in such an approach.

Eagleton opens his book with an account of the historical roots of the concept of 'culture' which he points out had as one of its original meanings the idea of 'husbandry' or the tending of natural growth. He then explores various agricultural connotations of the word. For example,

*'The word 'coultur', which is a cognate of 'culture' means a blade of a ploughshare. We derive our word for the finest of human activities from labour and agriculture, crops and cultivation. Francis Bacon writes of 'the culture of manurance of minds', in a suggestive hesitancy between dung and mental distinction. 'Culture' here means an activity, and it was a long time before the word came to denote an 'entity' (Eagleton, 2000: 1).*

Later, Eagleton presses his point home:

*'If culture originally means husbandry, it suggests both regulation and spontaneous growth. The cultural is what we can change, but the stuff to be altered has its own autonomous existence, which then lends it something of the recalcitrance of nature. But culture is also a matter of following rules, and this too involves an interplay of the regulated and the unregulated - rules, like cultures are neither shereley random nor rigidly determined - which is to say that both involve the idea of freedom. Someone who was entirely absolved from cultural conventions would be no freer than someone who was their slave (Eagleton, 2000: 4).*

All this reminds one of the way the Dutch term 'cultuur' is used both to refer to agricultural and natural resource management practices as well as the cultural practices of social life. Eagleton's observations not only mirror the theoretical and methodological position taken in this thesis but also provide a suitable title for my study: *Husbanding the Land* which embraces both the significance of cultural and more strictly agricultural practices.

### *Culture and agricultural practices*

Chapters Two and Three have elaborated from a historical and contemporary perspective the transformation of the Siaya landscape and the encounter of Luo values and norms with those of Christianity as well as with those of African tribes and the Europeans. Luo agriculture has changed dramatically, not only in the technical sense but also socio-culturally as a result of such encounters. These chapters underline that the Luo are strongly attached to land, and that land does not merely represent a plot of earth. Land, and thus also land use, needs to

be understood more widely and in relation to the complex social relationships that link land with cultural, social and technical practices. The case material illustrates how practices such as *golo kodhi* and *dwoko cham* both reproduce father-son relationships and the power associated with such relationships, but in turn, it also shapes how the land is used and the choices that are made. The cases also help to illuminate the problems that exist in labour relations in the research villages and through them I explore the negotiations and re-negotiations among farmers that form the 'centre play' of cultural practices such as *golo kodhi* and *dwoko cham*. *Golo kodhi*, in particular, is important to picture in relation to the choices as to which maize varieties to plant.

The exploration of land tenure reveals the confusion that arises when customary and private land tenure arrangements are mixed in everyday life and thus become unavoidably entangled in day-to-day problems. Each party to the conflict reverts to the tenure arrangement that fits their particular interests, and engages in strategic positioning. Such cases generate the kinds of conflicts and ambiguities over land and inheritance with which Kenya as a nation, with its recent politically and ethnically induced land conflicts, is grappling. In the absence of an integrated land policy, the unresolved issue of land tenure persists. All the more so because many farmers in the same position as Oluoch Agulu embrace 'modernity' by incorporating its values and virtues in their life styles. The first step is to discard Luo customs and embrace Christianity. Being 'saved' seems to provide some alternative.

The cases also highlight inter-generational relationships and tensions. These tensions can partly be traced to the misfit of technological change from outside with existing Luo cultural repertoires. The tensions can also be explained in terms of the encounter with different bodies of knowledge to which Luo society has been exposed since the late 19<sup>th</sup> century. The younger generation has developed a more individualistic attitude. They are eager to obtain their own title deeds, since this would enable them to make their own plans, without having to accept the authority of an elder, a father or a brother. However, in conflict situations, the owner of the homestead, in most cases the person holding the title deeds, tends to hold on to these as long as possible in order to maintain his authority. In many cases, this hampers the construction of a proper inheritance arrangement, which might mean the continuation of the quarrel between sons after the father's death. In the 'old' days, the eldest son succeeded his father as head of the homestead, but in more recent times younger brothers often question and challenge his position. Without title deeds it is difficult to get loans for investment in agricultural production or other economic activities, or for supporting polygyny, through the provision of bridewealth for several wives.

The cases also pinpoint the crucial importance of labour relations. In general, the Luo case is one of lineages where labour is abundant but cannot be mobilised because kinsmen do not like working for kinsmen, even though help from such a source might be expected. As in many other situations, it is always hard to work with your own kinsmen. If farmers succeed in tapping their labour, they always negotiate financial rewards and the system of kinship relations limits room for negotiations for those that demand labour. And, there is no guarantee in the end that they will work for others.

Crop production per se is shaped by the principle of *golo kodhi and dwoko cham*, the principle of seniority whereby the eldest within a lineage or homestead (*dala*), should carry out certain agricultural activities first, such as sowing and harvesting, after which the rest can follow in order of seniority. This must have served a useful purpose when the agricultural experience and knowledge of elders would have contributed to wise decisions about when to plant and harvest. But with the spread of new varieties and related choices in agriculture, *golo kodhi* is perceived by the younger generation as a hindrance to their aspirations to be modern and more adventurous in their agricultural choices. Indeed, there has been a remarkable transformation due to encounters with Christian and Western values. Some people say they do not believe nor practise the custom anymore. In other cases it is confined only to the *dala*, whereas others have replaced *golo kodhi* by Christian ceremonies, such as offering prayers before sowing maize. This also indicates that, although farmers tend to share knowledge, this does not mean that they hold to exactly the same types of knowledge or beliefs. The penetration of Christianity and other Western norms and values has intensified negotiations and multiplied outcomes.

After every growing season, Oluoch Agulu takes 10% of his harvest to the Anglican Church of which he is a member. This custom has replaced the pouring of sorghum beer on the ground as an offering to the Luo ancestors. Some farmers openly state that they do not believe in Luo customs or in the consequences of disobeying them. Yiengo Rateng left his father's home before his elder brothers did so because he felt Luo customs, such as *golo kodhi*, prohibited him from farming in the way he wanted and thus obstructed his progress. When he left his father's home his relatives warned him of *chira* (sickness caused by witchcraft). But Yiengo Rateng himself does not believe in this and states that his success as a farmer and a businessman has strengthened this opinion.

Luo, like other peoples, tend to organise their daily lives by reference to kinship principles and customary arrangements and obligations which, although seldom talked about, silently mediate the tensions of contemporary, everyday Luo life.



*Socio-technical regimes and maize in Luoland*

The maize landscape in Kenya has evolved around different social processes, repertoires, experiences and commitments, and resonates with different bodies of knowledge as is apparent in the varying ways in which maize is selected, bred, multiplied and exchanged. Chapters Four and Five analyse the various socio-technical networks through which maize spread in Luoland and the regimes that sustain them. Most farmers in Luoland today produce maize from the regime based on the mass selection of local maize, rather than the maize generated by that based on modern hybrid and open pollinated variety breeding techniques. One argument given by farmers is that the myth of the superiority of hybrids no longer holds for them, particularly for those who have developed more trust in their own local varieties and socio-cultural practices. These social processes constitute the cores of the socio-technical niches that have emerged over time in Luoland.

In these chapters I draw attention to the ways that local maize is embedded in local knowledge and passed from one generation to another and shaped by local cultural repertoires. The direction of mass selection and breeding practices is less clear and more open ended compared to hybrid and recurrent selection. The networks are localised, based on experimentation and a dominant design and script is absent. Their development in the long run depends most probably on the willingness of farmers to exchange experiences.

Most interesting is the fact that local knowledge repertoires clearly question *and* contest scientific knowledge. Claims made by experts that their products are higher yielding are immediately counter-claimed by local farmers arguing that local maize tastes better, has nicer colours and out yields hybrids. The mass selection and breeding of local maize has the advantage above OPVs and hybrids that its technology development corresponds with the contexts of the users. Farmers certainly mention this as important when comparing local varieties with hybrids and OPVs. These issues point to knowledge encounters that are embedded in breeding, selection, and cultural practices.

Lastly, it is worthwhile drawing attention to a sensitive issue that emerges from my analysis. Over the years, interaction between the two different technical regimes has taken specific forms. One form is that of the 'modern' and hybrid maize varieties bred through the application of scientific principles that do not seem to fit with cultural practices, and are thus hardly any longer planted. Those that still plant hybrids do this in a redesigned way. A second pattern concerns the results of earlier breeding programmes invariably undertaken outside Kenya (e.g. South Africa and the United States) which brought varieties through early colonial state interventions. As I have shown, these varieties still feature today and most certainly have added genes to the existing gene pool of maize in the region. The hybrid maize regime, on the other

hand, has never completely managed to fulfil its 'mission' in the region. Added to this is the fact that the hybrid maize regime is at present contested and criticised by scientists (e.g. plant breeders) themselves. The Lagrotech Seed Company that released the Maseno Double Cobber is significant in that it shows how within the circles of plant breeders alternative ideas and practices emerge. In its turn, this is evidence that technological regimes and in particular the maize regimes based on the application of scientific principles of breeding are not homogenous at all. A variety of scenarios in maize breeding are followed at present in Kenya. If these breeding efforts interact more regularly with the mass selection and breeding regimes in the country, then there is hope for the future.

*The soil fertility domain and paradigmatic change*

Given the relative success of the Green Revolution in increasing food production, many argue that intensive packages of improved varieties and fertiliser should be widely applied as the model for agricultural development and as a means of ensuring household and national food security (Borlaug, 1988). Although this sounds appealing, this thesis shows that there are numerous constraints that curtail adoption of this approach in Siaya district.

Farmers who can neither afford nor rely on a regular supply of mineral fertilisers must be able to obtain alternative sources of nutrients. Low-cost technologies and practices for supplying nutrients to crops are needed on a scale wide enough to improve the livelihood of farmers. In this thesis, I have analysed alternative and practical approaches of increasing domestic food production using improved fallows with *Sesbania sesban*, *Crotalaria grahamiana* and *Tephrosia vogelii* and also through the use of Green Biomass manure transfer from the prunings of the weed *Tithonia diversifolia*. This approach builds upon farmers' traditional production strategies and on collaborative national and international research efforts and represents regime change 'from within' and 'from below'.

In chapter Six I explored how changes in macro-economic policies concerning mineral fertilisers have impacted on soil fertility management in the entire country. In the 1990s these practices were affected by structural adjustment programmes and associated policies such as devaluation, the liberalisation of crop and input prices, the abolition of subsidies, changes in input delivery and agricultural credit systems, and the downsizing of government services. These policies have altered the cost of inputs for most crops and put mineral fertilisers and credit beyond the reach of many farmers who formerly had access to them. From the case study, I concluded that the 'unintended' effect of many structural adjustment programmes has been to reduce the use of mineral fertilisers, marketing support services and credit systems. Even more, the liberalisation

policy has opened the door to more traders who adulterate<sup>1</sup> fertilisers in order to make profit without caring about their effects on the soil. Adulterated fertilisers are a root cause of farmers distancing from them.

In response to the decline in soil fertility, farmers have developed soil fertility management strategies of their own that correspond to what we call here the niche or 'hidden novelties' within the socio-technical landscape. These niches operate independently of the predominant fertiliser regime. Farmers put parts of their land under fallow for a period of at least six months; and practice organic matter recycling, crop rotation, and crop association. More radical strategies include the development of low-lying, swampy land for growing high-value vegetables and other crops.

The case study material I present in chapter seven shows how farmers look for alternatives to address the soil fertility problem, which they consider to be a priority across enterprises, crops and livestock alike. The introduction of the donor funded NDDP aimed at improving household food security through increased milk yield was perceived differently by some Luo farmers. During the search for alternatives, a group of farmers joined the zero grazing project as a means of obtaining manure for regenerating soil fertility. This group of farmers saw zero grazing as a way of re-establishing livestock/crop interactions that were largely lost due to the reduced numbers of African zebu cattle. Accumulation of manure for crop production is one of the unintended outcomes of the NDDP project. In their bid to seek options for survival, farmers draw upon bodies of knowledge from groups or agencies that help them adapt to ongoing processes of change.

Long fallow periods were historically used to regenerate the level of organic matter and nutrients, until increasing pressure on land reduced this possibility. Thereafter, application of animal manure became the most important source for soil fertility improvement. However, due to the decline in cattle population, quantities of manure produced have become insufficient for restoring soil fertility on all fields. Most farmers find inorganic fertiliser too expensive, unavailable at the right time, quite unsuitable as it spoils their soil when frequently used, and their crops get addicted to it so that which when not used the yield goes down. In chapter eight I focused mainly on the most recent technologies that are emerging from research and those that have been developed by farmers themselves aimed at improving soil fertility. It was also shown how farmers and researchers attempt to re-establish tree-soil-crop

---

<sup>1</sup> The issue of adulterated fertilisers has caused a public outcry in Kenya. It is now even debated openly in parliament. 'Fake fertilisers killing farming' says Obure, Minister of Agriculture in parliament (East African Standard newspaper, Thursday, March 29, 2001).

interaction, which was lost over time due to deforestation emanating from increased population.

These technologies constitute what other researchers call the second soil fertility paradigm and are based on sustainability considerations (Sanchez, 1999: 4). This paradigm focuses mainly on improved fallow technologies using trees and shrub legumes capable of fixing nitrogen through their roots and from the biomass from their leaves. Biomass transfer is another potential technology for restoring soil fertility and improving crop yield. Biomass can be obtained from *Tithonia diversifolia*, which is found in hedges in the area. As I mentioned earlier, on-farm research demonstrated a good response from maize when prunings are applied as green manure. However, the technology is very labour intensive. The quantity of biomass needed can be reduced when combining it with inorganic fertiliser. Crop yields will further increase when rock phosphate and farmyard manure are added. The single most important reason why farmers try improved fallows is because their soil is poor. Moreover, even those with moderately good soils will try improved fallows if they see the benefits of them, in order to save money they would otherwise use for fertiliser, or to reduce risks associated with fertiliser use. Some farmers with adequate access to farmyard manure and fertiliser try improved fallows on a minimal scale.

Unlike the Green Revolution projects that come in the form of packages and are highly linked to markets, SFRRP has emanated from farmers' own quest for alternatives to solve the agrarian and environmental crisis that faces them. Farmers have turned to look at their own environment after being let down by the institutions involved in Green Revolution projects. Unlike such projects, SFRRP does not have prescribed packages, leaving farmers free to experiment in anyway they wish. Furthermore, SFRRP, unlike Green Revolution projects, is not highly linked to markets. This serves well the interests of farmers with limited resources.

### **The response of the State and NGOs to distancing**

The focus of this section is to argue that not only have researchers like myself come to realise that farmers are distancing themselves from induced technological innovations, but that also State institutions (i.e. policymakers, agricultural researchers, extension workers) and NGO's acknowledge its occurrence. The question that poses itself is how the State and NGO's position themselves vis-à-vis this phenomenon.

The Kenyan State generally does not support farmer strategies based on distancing from the predominant technological regime. Four reasons can be advanced for this. First, the persisting strong belief in the superiority of hybrid maize. This belief is widely shared in government bureaucratic circles as well as in agricultural research institutions such as the government-funded Kenya

Agricultural Research Institute. Second, the top-down structure of the State bureaucracy normally prevents a flow of information from farmers experiencing problems with technologies to policy makers. Third, even if this information does reach policy makers, the Kenyan government nevertheless continues the propagation of hybrid maize in an attempt to realise the macro-objectives of national food self-sufficiency and the generation of foreign exchange. The objectives of farmers' strategies based upon distancing, conflicts with government objectives and cannot generate the required surplus maize for the market. Fourth, the employment freeze by the government, retirements, deaths and now retrenchment, have markedly reduced the number of extension workers. The ratio of farmers to extension worker in Siaya has increased to at least a 1000 to one. Hence, the ability of the Kenyan State to respond to the distancing from Green Revolution technologies such as hybrid maize and inputs should not be overestimated.

However, it should also be noted that government extension workers show some understanding of why farmers distance themselves from hybrid maize cultivation. Yet despite this, extension workers keep on propagating high yielding varieties of maize because they themselves form part of the wider socio-technical regime of these modern varieties. They are caught, therefore, as it were, between 'a rock and a hard place'. Since the government provides extension workers with a job, a salary and with promotion opportunities, they (officially) are inclined to implement government policy. However, at the same time, they empathise with those farmers who have distanced themselves from the dominant hybrid maize regime and have reverted to cultivating local maize embedded in local cultural practices, and who do not use fertiliser. They have been displaced by farmers from the centre of development activities to the periphery, and they know it. Furthermore they are exposed to the realities of rural life.

The NGO-like institutions have also been enrolled by farmers in their projects and some fully support farmers' strategies based upon distancing from hybrid maize. This they do by conducting adaptive research on local maize cultivation with farmyard manure and other endogenous resources. There are at least two reasons why certain NGOs support farming households that have abandoned hybrid maize while the government does not. First, contrary to the State, NGOs and international research institutes like ICRAF have no top-down bureaucracy, which means that they are more flexible and better able to adjust policy. Second, NGOs and ICRAF do not have to look after macro-objectives such as national food self-sufficiency and the generation of foreign exchange, which makes it easier for them to bring their objectives in line with those of farmers. However, one should not idealise the NGOs. Their activities are not always as bottom up as they present them or would like them to be. Furthermore, their

objectives do not always neatly coincide with those of farmers. For example, many NGOs have formulated the objective of enhancing environmental security on the basis of which the recommendation was developed to plant trees. Farmers who often have small plots are not always enthusiastic about tree planting.

Since NGOs are more flexible and do not have to look after macro-objectives, farmers have been able to enrol them in their projects and to organise them in such a way that desired outcomes are (partly) realised, e.g. support for strategies based upon distancing from hybrid maize. However, NGOs have also enrolled farmers in order to achieve their objectives, e.g. the enhancement of environmental preservation via the planting of trees. And regarding problems of soil fertility, they have convinced farmers to grow shrubs that fix nitrogen and transfer biomass as improved fallow.

### **Luo farming practices: looking at the future**

This study argues for a two track policy, supporting both farming households who have developed their own technologies 'from below' such as the zero type of James Otieno in Nyamnina village, as well as those who continue with hybrid maize or look for open pollinated varieties. The challenge is to set up a proper system of seed production, distribution, marketing, retailing and quality control. These ideas centre on setting up small seed businesses and/or community-based organisations. Experience with community seed programmes shows, however, that these issues are not easy to resolve. The lack of stability and reliability are what hamper organisations of this type. It is worth noting that in contrast to the 'modern' regime, the dynamics of niches are such that a mass of options emerge over time, which are part and parcel of the cultural, social, institutional and environmental context in which such niches evolve. The 'modern' hybrid maize regime offers limited choices. Another important issue is that OPV breeding is based on genetic variation through cross-pollination and recycling. Maintaining genetic variation and accessing genetic material is hence crucial.

With regard to soil fertility, more emphasis should be given to organic sources of fertilising soil, given that farmers' confidence in inorganic fertilisers has waned ever since Green Revolution programmes were propagated. How, then, is one to address the African situation now that Sub-Saharan Africa has the lowest use of fertiliser in the world and soil nutrients are so low that other efforts to raise crop productivity would not be successful until fertility was improved. The answer to this question lies in capturing what I have called the socio-technical changes that take place 'from within' and 'from below'. It is only by embracing such processes of niche development within the wider socio-technical landscape that appropriate technologies - independent of the

predominant fertiliser regime - can be developed to complement soil fertility management. Second, the soil fertility programme, based on considerations of sustainability using leguminous trees and shrubs and biomass transfer, has shown positive results on experimental plots and should therefore be encouraged alongside other options, even though their sustainability in the wider socio-technical landscape is doubtful. Technically, one could say that agro-forestry technologies are a second soil fertility option, though in social and practical terms this appears not to be the case, since the majority of farmers question their sustainability as soon as the project is over.

An alternative, but quite unrealistic way to improve agricultural development, is to provide farmers with sources of well-paid off-farm employment. This, however, requires political and economic changes at the national and global levels, which are not foreseeable in the immediate future. This is unfortunate since the mobilisation of capital is crucial to solving labour and technology deficits and the pressures on land. The distancing of farmers from predominant technical regimes is partly the result of the lack of capital for practising plough agriculture among other things. Furthermore, additional income sources could release pressure on cultivation and the fragmentation of land holdings due to demographic increase. Hence, for the time being, Luo farmers must struggle on in creating viable niches for themselves in an effort to meet their livelihood needs. Some, as this thesis shows, will go beyond survival strategies to develop viable alternative farming practices from which agricultural scientist and policy makers might fruitfully learn.

## Bibliography

- Acland, J.D., 1971, *East African Crops*. An introduction to the production of field and plantation crops in Kenya, Tanzania and Uganda. FAO. Singapore.
- Longman
- AFRENA, 1996, *Maseno Project rapport*. Report no. 110. ICRAF/KEFRI/KARI Maseno
- AFRENA, 1997, *Maseno Project rapport*. Report no. 122. ICRAF/KEFRI/KARI Maseno
- AFRENA, 1998, *Maseno Pilot Project Technical report* No. 11 ICRAF/KEFRI/KARI
- Anderson, B. and Carlos, M., 1976, What is Social Network Theory?, In T.R Burns and W. Buckley (eds.). *Power and Control: Social structures and their transformation*. London. Sage International
- Anyang' Nyong'o, P., 1981, The Development of a middle Peasantry in Nyanz, in: *Review of African Political Economy*, no. 20, pp. 109-125
- Arce, A. and N. Long, 1992, The Dynamics of Knowledge Interfaces between Bureaucrats and Peasants. A case from Jalisco, in: Long, N. and A. Long (eds.), *Battlefields of Knowledge; the Interlocking of Theory and Practice in Social Research and Development*. Routledge: London and New York
- Argwings-Kodhek, O., 1996, *The evolution of fertilizer marketing in Kenya*: Paper presented at the conference on fine-tuning market reforms for improved agricultural performance policy analysis project, Egerton University, Kenya.
- Benvenuti, B., 1982, De technologisch-administratieve taakomgeving (TATE) van landbouwbedrijven, in: *Marquetalia*, no. 5
- Berry, S., 1984, The food crisis and agrarian change in Africa - a review essay, in: *African Studies Review*, vol. 27, no. 2, pp. 59-113
- Bindlish, V. and R. Evenson, 1993, *Evaluation of the Performance of T&V Extension in Kenya*. World Bank Technical Paper Number 208. Washington, D.C.
- Boissevain, J., 1974, *Friends of Friends; Networks, Manipulators and Coalitions*. Oxford: Oxford University Press
- Bookman, Anne Edith, 1973, *The changing economic role of Luo women*. M.A. Thesis. Department of Anthropology, Harvard University



- Booth, D., (ed.), 1994, *Rethinking social development: theory, research and practice*. Harlow: Longman
- Borlaug, N., 1988, Challenges for global food and fibre production, in: *Journal of the Royal Swedish Academy of Agriculture and Forestry*, Supplement 21: 15-55
- Box, L., 1989, Knowledge, Networks and Cultivators: Cassava in the Dominican Republic, in: N. Long (eds). *Encounters at the Interface: A Perspective on Social Discontinuities in Rural Development*. Wageningen: Wageningen Agricultural University. Wageningen Studies in Sociology 27
- Buttel, F.H., 1994, Agricultural Change, Rural Society, and the state in the late 20<sup>th</sup> Century: Some theoretical observations, in D. Symes and A.J. Jansen (eds.), 1994, *Agricultural Restructuring and Rural Change in Europe*. Agricultural University Wageningen. Netherlands. Grafisch bedrijf Ponsen & Looijen
- Callon, M. and B. Latour, 1992, Don't throw the baby out with the Bath School! A reply to Collins and Yearley, in: A. Pickering (ed.), *Science as practice and culture*. Chicago: University of Chicago Press, pp. 343-368
- CARE/KEFRI., 1996, *Preliminary results of on-farm farmer/researcher managed adaptive research experience in Siaya*. Homa Bay/Migori, Siaya
- Chambers, R. and R. Ghildyal, 1985, *Agricultural Research for Resource poor farmers: A Parsimonious Paradigm*. Brighton (Sussex): IDS, Discussion paper 220.
- CIMMYT, 1990, *Annual Report*. Mexico City: CYMMIT
- Cohen, D. & E.S. Atieno Odhiambo, 1989, *Siaya: The Historical Anthropology of an African Landscape*. Nairobi/London/Athens. U.S.A.: Heinman Kenya/James Currey/Ohio University Press
- Cohen, D., 1983, Food production and food exchange in the pre-colonial lakes region plateau, in: R. Rotberg (ed.), *Imperialism, colonialism, and hunger: East and Central Africa*. Lexington Books: Lexington
- Cowen, M., 1974, *Patterns of Cattle Ownership and Dairy Production*. Economics Department, University of Nairobi (Mimeo)
- Crazzolaro, J., 1954, *The Luo Verona: Mission in Africa 1950-1954*
- Crehan K. and A. von Oppen, 1988, Understanding of 'development': An Arena of Struggle. The story of a development project in Zambia, in: *Sociologia Ruralis*, Vol. XXVIII, No 2-3.

- Dommen. A.D., 1988, *Innovation in African agriculture*. Boulder, USA.: West view Press
- Drinkwater, M., 1994, Knowledge, consciousness and prejudice: adaptive agricultural research in Zambia, in: I. Scoones and J. Thompson (eds.), *Beyond farmer first*. London: Intermediate Technology Publications. Pp32-41
- Drummond, I., 1996, Sweet and Sour: The dynamics of sugar cane agriculture, in: *International Journal of Sociology of Agriculture and Food*, vol. 5, pp 40-66
- Dupre, C.E., 1968, *The Luo of Kenya and Annotated Bibliography*. Institute for cross-cultural research. Washington, D.C.
- Eagleton, T., 2000, *The Idea of Culture*. Oxford: Blackwell
- Ekeya, B. and J. Akong'a, 1986, Social Values and Customs, in: G.S. Were and R. Soper (eds.). *Socio-Cultural Profiles: Busia District. Kenya*
- Engel, P., 1991, *Knowledge Management in Agriculture: Building upon Diversity*, in: Proceedings of the European Seminar on Knowledge Management and Information Technology, Wageningen: Wageningen Agricultural University
- Fearn, H., 1961, *An African economy. A study of the economic development of the Nyanza Province of Kenya, 1903-1959*. London: Oxford University Press
- Fetterman, D., 1989, *Ethnography, step by step*. London: Sage Publications
- Food Agricultural Organisation, 1994, *Production yearbook*. Rome: FAO
- Francis, E and J. Hoddinott, 1993, Migration and Differentiation in Western Kenya. A tale of two sublocations; In: *Journal of Development Studies* 30(1): pp 115-145
- Franzel et al., 1999, *Assessing the Adoption Potential of Improved Tree Fallows in Eastern Zambia*. AFRENA Working Paper No. 124, ICRAF, Nairobi
- FURP, 1994. *Fertiliser use recommendations*, vol. 1-23. Nairobi: KARI, FURP
- Geels, F. and R. Kemp, 2000, *Transities vanuit sociotechnisch perspectief. Achtergrondrapport voor het vierde Nationaal Milieubeleidsplan*. Enschede: University of Twente
- Gerhart J.D., 1974, *The Diffusion of hybrid maize in Western Kenya*. Ph.D Dissertation, Princeton University
- Gerhart, J.D., 1975, *The Diffusion of Hybrid Maize in Western Kenya*. Abridged by CIMMYT. Mexica City
- Gerhart, J.D., 1976, *The diffusion of hybrid maize in Western Kenya*. Princeton: Princeton University Press

- Giddens, A., 1984, *The Constitution of Society. Outline of the Theory of Structuration*. Cambridge, Polity Press
- Grant J.A. 1965. A walk across Africa: Maize, in: *Uganda Journal*, vol. 13. pp 216-219
- Greer, J., Thorbecke, E., 1986, *Food poverty and consumption patterns in Kenya*, Geneva, ILO, WEP project report
- Griffin, K., 1979, *The political economy of agrarian change*, Cambridge, Cambridge University Press
- Hanyani-Mlambo, B. and P. Hebinck, 1996, Formal and informal knowledge networks in conservation forestry in Zimbabwe, in: *Indigenous Knowledge and Development Monitor* (forthcoming, vol. 4, nr. 3)
- Harrison, M.N., 1970, Maize Improvement in East Africa, in: C.L.A. Leakey, (eds), *Crop Improvement in East Africa*. London: Farnham, Royal
- Hay, M.J., 1972, Economic Change in late Nineteenth Century, Kowe, Western Kenya, in: B.A. Ogot (eds), *Economic and Social History of East Africa*. Nairobi. Kenya Literature Bureau
- Hay, M.J., 1976, 'Luo women and economic change during the colonial period', in: N. Hafkin and E.G. Bay (eds), *Women in Africa: studies in social and economic change*. Stanford, Cal.: Stanford University Press
- Hay, M.J., 1982, 'Women as owners, occupants and managers of property in colonial western Kenya, in: M.J. Hay and M. Wright (eds), *African Women and the Law: historical perspectives*. Boston, Mass.: Boston University, African Studies Centre
- Hayami, Y. & V. Ruttan, 1985, *Agricultural development in an international perspective* (second and revised edition), Baltimore/London, The Johns Hopkins University Press
- Hebinck, P.G.M., 1990, *The Agrarian Structure in Kenya: State, farmers and commodity relations*. Saarbracken/Fort Lauderdale: Breitenbach publishers.
- Hebinck, P., 1995, Intervention and the black box: a case study of maize farming in Nandi District, Kenya, in: Frerks, G. and J. den Ouden (eds.), *In search of the middle ground. Essays on the sociology of planned development*, Wageningen, Wageningen Agricultural University, pp. 164-186

- Hebinck, P., 2001, Maize and socio-technical regimes, in: Hebinck, P and G. Verschoor (eds), *Resonances and Dissonances in Development. Actor, networks and cultural repertoires*, Assen:Van Gorcum, pp. 119-139
- Hebinck, P and J.D. van der Ploeg, 1997, Dynamics of agricultural production. An analysis of micro-macro linkages, in: Haan, de H and N. Long (eds.), *Images and realities of rural life. Wageningen perspectives on rural transformations*. Assen: Van Gorcum. Pp.202-226
- Heyer, J., 1975, The Origins of Regional Inequalities in Smallholder Agriculture in Kenya, 1920-73, in: *East African Journal of Rural Development*. Volume 8 #s 1 and 2, pp 142-81
- Hindess, B., 1986, 'Actors and Social Relations', In: M.I. Wadell and S.P. Turner (eds), *Sociological Theory in Transition*. Boston: Allen and Unwin
- Hobart , M., 1993, *An Anthropological Critique of Development, The Growth of Ignorance*. London, Routledge
- Hobart, M., 1995, 'Black umbrellas: the implication of mass media in development,'EIDOS Workshop on Globalization and Decivilization, Agricultural University of Wageningen, November
- Howard-Borjas, P., 2001, *Women in the plant world: the significance of women and gender bias for botany and for bio-diversity conservation*. Inaugural address, Wageningen University and Research Centre
- Jaetzold, R. and Schmidt, H., 1982, *Farm Management Handbook of Kenya, Vol. II Part A West Kenya (Nyanza and Western Provinces)*, Ministry of Agriculture, Nairobi, Kenya
- Jager A. de et. al., 2001, *Exploring new pathways for innovative soil fertility management in Kenya*. Managing African Soils No.25. IIED-Drylands programme. Russel Press, Nottingham , UK
- Jama, B. et al., 1999, *Tithonia diversifolia green manure for improvement of soil fertility: a review from Western Kenya*. Agroforestry Systems (in press).
- Juma, C., 1989, *The gene hunters. Biotechnology and the scramble for seeds*. African Centre for Technology Studies research series, no.1. London, Zed books
- Kahnt, G., 1983, *Grundungun*. 2. Verb. Auflage. DLG-Verlag, Frankfurt/M
- Kenya National Archives, 1907, Kisumu annual report
- Kenya National Archives, 1913, Kisumu annual report
- Kenya National Archives, 1923, Kisumu annual report

- Kenya National Archives, 1929, Kisumu annual report
- Kenya National Archives, 1917, Nyanza Province Annual Report
- Kenya National Archives, 1918, Nyanza Province Annual Report
- Kenya National Archives, 1940, Nyanza Province Annual Report
- Kenya National Archives, 1941, Nyanza Province Annual Report
- Kenya National Archives, 1942, Nyanza Province Annual Report
- Kenya National Archives, 1947, Nyanza Province Annual Report
- Kenya National Archives, 1948, Nyanza Province Annual Report
- Kenya National Archives, 1949, Nyanza Province Annual Report
- Kenya National Archives, 1950, Nyanza Province Annual Report
- Kenya National Archives, 1951, Nyanza Province Annual Report
- Kenya National Archives, 1957, Nyanza Province Annual Report
- Kenya National Archives, 1958, Nyanza Province Annual Report
- Kenya National Archives, 1956, Nyanza Province Annual Report
- Kessel, C. van, 1998, *Adoption, Adaptation, Distancing and Alternative Networks. An analysis of farmers' responses to a hybrid maize technology package in Yala Division, Western Kenya*. Unpublished M.A Thesis. Dept. of Development studies. Nijmegen Catholic University
- Kitching, G. 1980 *Class and economic change in Kenya*. The making of an African Petite Bourgeoisie. 1905-1970. New Haven and London. Yale University Press
- Kloppenburger, J., 1988, *First the Seed. The political economy of plant biotechnology, 1492-2000*, Cambridge, Cambridge University Press
- Landlands, B.W., 1965, *Maize in Uganda*, in: Uganda Journal, vol. 2, no. 29, pp 215-221
- Latour, B., 1983, Give me a laboratory and I will raise a world, in: Knorr-Cetina, K. and M. Mulkay (eds.), *Science observed: perspectives on the social study of science*, London, Sage Publications
- Latour, B., 1994, On Technical Mediation – Philosophy, Sociology, Genealogy, in: *Common Knowledge*, vol. 34: 29-64
- Lavrijsen, J., 1985, *Rural poverty and impoverishment in Western Kenya*, Utrecht, Rijks Universiteit Utrecht, Utrechtse Geografische Studies no. 33
- Leegwater, P., Ngolo, J. and Hoorweg, J., 1990, *Nutrition and Dairy Development in Kenya*, (Draft Report), African Studies Centre, Leiden

- Leys, C., 1975, *Underdevelopment in Kenya. The political economy of neo-colonialism, 1964-1971*. London: Heinemann
- Lipton, M., Longhurst, R., 1989, *New seeds and poor people*, London, Unwin & Hyman,
- Lofchie, M.F., 1985, Africa's agrarian malaise, in: Carter, G., O'Meara, P., (eds), *African independence. The first twenty-five years*, Bloomington, Indiana University Press, pp. 161-188
- Long, N., 1968, *Social Change and the Individual. A study of the social and religious responses to innovation in a Zambian rural community*. Manchester University Press
- Long, N., 1986, Commoditisation: Thesis and Antithesis, in: N. Long, J.D. van der Ploeg, L. la Rive Box & C. Curtin (eds). *The Commoditisation Debate: Labour Process, Strategy and Social Network*. Paper of the department of sociology, no 17 Wageningen. PUDOC. pp 9-23
- Long, N., 1989, *Encounters at the Interface. A Perspective on Social Discontinuities in Rural Development*. Wageningen Agricultural University.
- Long, N., 2001, *Development Sociology: Actor perspectives*. London: Routledge
- Long, N. and J.D. van der Ploeg, 1988, New challenges in the sociology of rural development, in: *Sociologia Ruralis*, vol. 28 (1): 30-42
- Long, N and J.D. van der Ploeg, 1989, Demythologising planned intervention: an actor perspective, in: *Sociologia Ruralis*, vol. 29, no. 1, pp. 30-42
- Long, N. and J.D. van der Ploeg, 1994, Heterogeneity, actor and structure: towards a reconstitution of the concept of structure, in: Booth, D., (ed.), *Rethinking social development. Theory, research and practice*, Harlow, Longman, pp. 62-90
- Long, N. and A. Long (eds), 1992, *Battlefield of Knowledge, The Interlocking of Theory and Practice in Social Science Research and Development*. Routledge, London.
- Long, N. and M. Villareal, 1993, 'Exploring Development Interfaces: From Knowledge Transfer to Transformation of Meaning', in: F.J. Schuurman (ed.) *Beyond the Impasse; new directions in development theory*. pp. 1-34. London: Zed Books

- Long, N. and M. Villareal, 1994, 'The interweaving of knowledge and power in development interfaces', In: I. Scoones and J. Thompson eds., *Beyond farmer first* (Intermediate Technology Publications, London. pp 41-52
- Long, S.A., 1992, 'Goods, knowledge and beer: the methodological significance of situational analysis and discourse', in: N. Long and A. Long (eds) *Battlefields of Knowledge: the interlocking of theory and practice in social research and development*. Routledge: London
- Louwaars, N.P. and G.A.M. Marrewijk, 1997, *Seed Supply Systems in Developing Countries*. CTA Publication. Wageningen The Netherlands, Reading UK. The Papyrus Press, Whitchurch Hill
- Mango, N., 1996, *Farmers responses to the Agrarian Crisis in Siaya District, Kenya. An analysis of how farmers 'internalise'; induced technology interventions in dairy farming*, Wageningen, Wageningen Agricultural University, M.Sc. thesis
- Mango, N., 1999, *Integrated soil fertility management in Siaya District, Kenya. Managing Africa soils No.7*. IIED-Drylands programme. Russel Press, Nottingham , UK
- Maxon, R. and Ndege, P., 1995, 'The economics of Structural Adjustment', In: B. Ogot and W. Ochieng, *Decolonization and independence in Kenya*. James Curry, London. pp151-186
- Mbithi, P.M. and Barnes, C., 1975, *The spontaneous settlement in Kenya, East Africa*
- McGuire, J., (1982) Incorporating nutrition objectives in development projects, in: Migot-Adhola, S., Nkinyangi, J., eds), *Food and Nutrition Planning in Kenya*. Nairobi, Institute for Development Studies, IDS Consultancy Paper no. 4,
- Melkote S.R., 1988, Agricultural Extension and Small Farmer: Revealing the Communication Gap in an Extension Project in Kenya, in: *East African Journal of Rural Development*
- Miracle, M.P., 1966, *Maize in Tropical Africa*. Madison, Malwaukee, and London. The University of Wisconsin Press
- Mitchell, J.C., 1969, *Social Networks in Urban Situations*. Manchester. Manchester University Press
- Mitchell, J.C., 1983, *Case and Situational Analysis: The Sociological Review*. 31 : 2 (New Series) P. 187-211
- MLD., 1983, *Implementation Document, Dairy Development Project Phase III*, Nairobi

- Mongbo, R., 1995, *The Appropriation and Dismembering of Development Intervention. Policy, discourse and practice in the field of rural development in Benin*. Ph.D Thesis, Wageningen Agricultural University. Grafisch Service Centrum Van Gils BV
- MPND, 1989, *Siaya District Development Plan 1989/1993*, Ministry of Planning and National Development, Nairobi
- Muchena, F.N. and Kiome, R.M., 1995, *The role of soil science in agricultural development in East Africa*: In *Geoderma* 67 (1995) 141-157. KARI-NARL, Nairobi
- Mulamula, H.A.H., 1992, *Pilot farming systems approach project. A Supervision Report on Kakamega and Nandi Districts*. KARI-RRC Kakamega, Kenya
- Muma, M.A., 1994, *Farmers' criteria for assessing zero-grazing innovation in Dairy Production*. Kenya. M.Sc. Thesis. Wageningen Agricultural University. The Netherlands
- Niang et al., 1998, *Soil Fertility Recapitalization and Replenishment Project in Western Kenya. Progress Report, February 1997-July 1998*. Pilot project Report No.9. Regional Agroforestry Research Centre, Maseno, Kenya, 42 pp
- Norman, D.W., et al., 1987, *Reflections on two decades of research on Sorghum based farming systems in Northern Nigeria and Botswana*. Paper; 3<sup>rd</sup> Annual Conference on Food Security Research in Southern Africa, 1-5<sup>th</sup> Nov., 1987
- Ochieng', W.R., 1974, *An outline history of Nyanza up to 1914*. East African Literature Bureau, Nairobi
- Ochieng', W.R. and R.M. Maxon, 1992 *An Economic History of Kenya*. East African Educational Publishers Ltd. Nairobi, Kenya
- Ochola-Ayayo, A.B.C., 1976, *Traditional ideology and ethics among the southern Luo*. (PhD Thesis). Uppsala: Scandinavian Institute of African Studies
- Odinga, O., 1967, *Not Yet Uhuru*, London, Heinemann
- Ogada, F., 1969, *The role of maize research in stimulating agricultural progress in Kenya*. Paper presented to the East African Agricultural Economics Society conference
- Ogaro, V., 1997, *Participatory study on the adoption of soil improvement technologies at Mutsulio and Shihumbu villages, Shinyalu Division, Kakamega District*. KARI-RRC Kakamega. Kenya



- Ogaro, V. et al., 1999, *Soil fertility replenishment and recapitalisation project in Western Kenya. Technical report*. KARI/KEFRI/ICRAF. Kakamega, Kenya
- Ogot, Bethwell A., 1963, "British Administration in Central Nyanza District of Kenya, 1900-1960" In: *Journal of African History* Vol. iv No. 1, 2 and 3
- Ogot, B.A., 1967, *History of the southern Luo; migration and settlement*. Nairobi: East African Publishing House
- Ogot, B.A., 1968, Southern Luo, in: B.A. Ogot and J. Kieran (eds.), *Zamani*. East African Publishing House, 1968
- Oloo Aringo C., 1969, 'History of settlement: the example of Luo clans of Alego (1500-1918)', BA dissertation, University of East Africa (University College, Nairobi)
- Omosa, M., 1998, Re-Conceptualising Food Security. *Interlocking Strategies, Unfolding Choices and Rural Livelihoods in Kisii District, Kenya*. Ph.D Dissertation, Wageningen Agricultural University
- Onduru, D. et al., 2000, Soil fertility generation in Kenya, in: Hilhorst, T. and Muchena, F.M. (eds), 2000, *Nutrients on the move-Soil fertility dynamics in African farming systems*. International Institute for Environment and Development, London
- Ouden J.B. den, 1981, *Changes in land tenure and land use in a Bamalike chieftdom, Cameroon 1900-1980. An historical analysis of changes in control over people land and production*. Society of Applied Anthropology. 41<sup>st</sup> Annual Meeting, April 1981, Edinburgh
- Parkin, D., 1978, *The Cultural Definition of Political Response. Lineal destiny Among the Luo*. School of Oriental and African Studies, University of London. Academic press, London
- Ploeg, J.D. van der, 1990, *Labour, Markets and Agricultural Production*. Boulder, West View Press
- Ploeg, J.D. van der, 1992, *Strengthening Endogenous Development Patterns in European Agriculture*; Proceedings of a Seminar held at Chania. Brussels: European Commission
- Ploeg, J.D. van der and A. Long (eds.), 1994, *Born From Within. Practice and Perspectives of Endogenous Rural Development*. Van Gorcum, Assen
- Plummer, K., 1983, *Documents of life, An introduction to the problems and literature of a humanistic method*. London: George Allen & Unwin

- Pottier, J., 1993, *Practising Development: Social Science Perspectives*, London and New York: Routledge
- Prinz, D., 1986, *Increasing the productivity of small holder farming systems by introduction of planted fallows*. Plant Res. Dev. No. 24: 31-56
- Pritchard, E., 1965, Luo tribes and clans, in: E.E. Evans-Pritchard (eds). *The position of women in primitive society*. London: Faber, 205-27
- R.R.P., 1994, *Participatory rural appraisal report on Chamakanga Sub-location, Sabatia Division of Vihiga District*. KARI-RRC Kakamega. Kenya
- Republic of Kenya, 1981, *The National Food Policy: Sessional Paper no.4 of 1981*. Nairobi: Government Printer
- Republic of Kenya, 1992, *KARI Annual Report*. Nairobi
- Republic of Kenya, 1993, *Sixth development plan 1989-1993*, Nairobi: Government Printer
- Republic of Kenya, 1993a, Siaya District, *District annual report on agriculture*. Siaya. Kenya
- Republic of Kenya, 1994, *The national food policy: Sessional paper no. 2 of 1994*. Nairobi: Government Printer
- Republic of Kenya, 1994a, Siaya District, *District annual report on agriculture*. Siaya. Kenya
- Republic of Kenya, 1996, *KARI RRC-Kakamega, Annual Report*. Kakamega
- Republic of Kenya, 1997, *Stages and procedures in hybrid maize production*. KARI Training Course in Seed Technology, KARI RRC-Kakamega
- Republic of Kenya, 1997a, *Siaya District agricultural report*. Ministry of Agriculture, Siaya. Kenya
- Republic of Kenya, 1997b, *Yala Divisional agricultural report*. Ministry of Agriculture, Yala. Kenya
- Republic of Kenya, 1998, *Census statistical report*. Ministry of Planning and National Development. Nairobi
- Rhoades, R.E., 1984, *Breaking New Ground: Agricultural Anthropology*. CIP, Lima
- Richards, P., 1985, *Indigenous Agriculture Revolution*. Hutchinson & Co, London
- Richards, P., 1986, *Coping with hunger. Hazard and experiment in an African rice-farming system*, London, Allen & Unwin

- Richards, P., 1989, *Indigenous Knowledge Systems for Agriculture and Rural Development: The CICARD Inaugural Lectures*, Studies in Technology and Social Change, no. 13, Technology and Social Change Programme, Iowa State University, Iowa, USA
- Rip, A. and R. Kemp, 1998, Technological change, in: Rayner, S and E. Malone (eds), *Human choice and climate change*. Columbus: Battelle Press
- Rogers, E.M. and Shoemaker, F.F., 1971, *Communication of Innovations: A Cross-cultural Approach*. New York: Free Press
- Röling, N. G., 1990, The Agricultural Research-Technology Transfer Interface: A knowledge Systems Perspective, in: Kaimowitz, D. (eds), *Making the Link*. Boulder: Westview Press, 1-43
- Röling, N.G., 1992b, *Facilitating Sustainable Agricultural Changes and Policy Models*. Paper IDS workshop, Beyond Farmer First: Rural people's Knowledge, Agricultural Research and Extension Practice, University of Sussex, Brighton, October 27-29, 1992
- Röling, N.G. et al, 1976, The Diffusion of Innovations and the Issue of Equity in Rural Development, in: E.M. Rogers & B. Hills, *Communication and Development: Critical perspectives*: Sage
- Röling, N.G. and E. van de Fliert, 1993, *The Transformation of Extension for Sustainable Agriculture: The case of Integrated Pest Management in Indonesia*. Submitted to Agriculture and Human Values , special issue in 'Participation and Empowerment in Sustainable Rural Development'
- Rosenberg, N., 1983, *Inside the Block Box: Technology and Economics*. Cambridge. Cambridge University Press
- Rundquist F.M., 1984, *Hybrid Maize Diffusion in Kenya. Policies, Diffusion Patterns and Consequences. Case studies from Central and South Nyanza Provinces*. CWK Gleerup. Lund
- Ruthenberg, H. 1980. *Farming systems in the tropics*. Clarendon Press. Oxford.
- Sanchez, P., 1999, Improved fallows come of age in the tropics, in: *Agroforestry Systems*, 47: pp. 3-12
- Scherr, S.J. and Alitsi, E., 1990, *The development impact of the CARE Agroforestry Extension Project: Results of the 1989 adoption and impact survey*. Draft paper, CARE International in Kenya and ICRAF, Nairobi, Kenya

- Scott, J.C., 1985), *Weapons of the Weak. Everyday forms of Peasant Resistance*. Yale University Press
- Shipton, P., 1992, Debts and trespasses; land, mortgages, and the ancestors in western Kenya. *African Journal* 62 (3), 357-86
- Smaling, E.M.A., 1993, *An agro-ecological framework for integrated nutrient management with special references to Kenya*. Ph.D Thesis. Wageningen Agricultural University, The Netherlands
- Song, Y., 1998, "New" Seed in "Old" China. *Impact of CYMMYT Collaborative Programme on Maize Breeding in South-western China*, Ph.D dissertation, Wageningen, Wageningen University
- Southall, A., 1952, *Lineage Formation Among the Luo*. International African Institute. London: Oxford University Press
- Ssenyonga, J.W., 1997, Polygyny and Resource Allocation in the Lake Victoria Basin, in: Weisner, T.S. et al (ed.) *African families and the crisis of Social Change*. London: Bergin and Garvey
- Stichter, S., 1982, *Migrant labour in Kenya: capitalism and African response, 1895-1975*, London: Longman
- Stotz D., 1979, *Small Holder Dairy Development in the Past, Present and Future in Kenya*: M.Sc. Thesis. University of Stuttgart-Hohenheim
- Swynnerton, R.J.M., 1954, *A plan to Intensify the Development of African Agriculture in Kenya*. Nairobi. Government printer
- Thomas, et al., 1997, *Soil and Water Conservation for Kenya*. Soil and Water Conservation Branch, Ministry of Agriculture, Livestock Development and Marketing, Republic of Kenya. Nairobi
- Tiffen et al., 1994, *More People, Less erosion: Environmental Recovery in Kenya*, Chichester: John Wiley
- Valk, van der, 1990, *Review report of the DEAF surveys during 1988*, NDDP. Ministry of Livestock Development. Naivasha
- Villarreal, M., 1992, 'The poverty of practice', In: N. Long and A. Long (eds), *Battlefields of knowledge*. (Routledge, London .pp 247-267
- Vries, P. de, 1992, *Unruly Clients: A study of How Bureaucrats Try and Fail to Transform Gatekeepers, Communists and Preachers into Ideal Beneficiaries*. Ph.D Dissertation, Wageningen Agricultural University

- Vries, P. de, 1992b, A research Journey, in: N. Long and A. Long (eds) *Battlefields of Knowledge: the interlocking of Theory and Practice in Social Research and Development*. London: Routledge. pp 47-84
- Warren, D.M., 1990, *Indigenous Knowledge and Development*. Seminar series on sociology and natural Resource Management. World Bank, Washington
- Webner, R., 1991, *Tears of the dead. The social biography of an African Family*, Baobab books, Harare
- Were, Priscilla, 1972, *The Origin and Growth of the Iron Industry and Trade in Samia (Kenya)*. B.A. dissertation, Department of History, University of Nairobi
- Wilson, G., 1961, *Luo customary law and marriage law customs*. Nairobi: The Colony and Protectorate of Kenya
- Wiskerke H, and J.D van der Ploeg (eds), 2002, *The dynamics of agricultural innovation at the interface of novelty creation and socio-technical regimes* (forthcoming)
- World Bank, 1981, *Accelerated development in Sub-Saharan Africa. An agenda for action*. Washington
- World Bank, 1985, *Kenya Agricultural inputs review*. Vol. 1 en 2, Nairobi, World Bank, Eastern Africa Projects (white cover)
- World Bank, 1984a, *Towards sustained growth in Sub-Saharan Africa*, Washington ,
- World Bank, 1982a, *World Development Report 1982*. New York, Oxford University Press
- World Bank, 1989, *World Development Report 1989*, New York, Oxford University Press
- Wright, A.C.A., 1949, *Maize names as indicators of economic contact*. In: Uganda Journal, No. 13, pp 61-81

**Newspapers/ and other literature.**

The Holy Bible

Daily Nation, 1999a, Poor farming blamed on ignorance. 9-4-1999, page 27

East African Standard News Paper, Friday, February 9, 2001

## Samenvatting

Dit proefschrift dient geplaatst te worden in het debat over de aard en dynamiek van agrarisch ontwikkeling en socio-technische veranderingen. Het eerste hoofdstuk werkt in detail het theoretische kader uit waarmee het onderzoek is uitgevoerd. Hierbij is voortgeborduurd op het veelvuldig aangevoerde argument dat modernisatie en neo-marxistische theorieën niet voldoende in staat zijn om de complexiteit van agrarische ontwikkeling te verklaren. Deze theorieën schieten met name tekort in het verklaren van contrasterende boerenstrategieën. We zien enerzijds strategieën van boeren die samengaan met die van tal van instituties en die gericht zijn op het gebruik van nieuwe technologie en de markt; anderzijds zien we strategieën die juist voortbouwen op het afstand nemen van dezelfde markt en het vigerende aanbod van technologie. Terwijl de dynamiek van agrarische ontwikkeling en technologische verandering veelvuldig is voorgesteld als rechtlijnig, onderschrijft het empirisch materiaal dat verzameld is in de context van dit onderzoek in Luoland, een regio in het westen van Kenia, het belang van de conceptualisering van ontwikkelingsprocessen als zijnde niet-lineair. Ten einde dit soort processen te analyseren, wordt een benadering uitgewerkt die 'human agency' toekent aan boeren, boerinnen, landbouwvoorlichters en onderzoekers; een benadering die ondermeer het vermogen van boeren onderkent om hun eigen leven vorm te geven.

De verzameling en interpretatie van empirisch materiaal concentreerde zich op twee domeinen van de agrarische productie: verschillende variëteiten van maïs en aspecten van bodemvruchtbaarheid. Deze domeinen worden door de betrokken actoren onderkent als zijnde belangrijk, maar de oplossingen die worden voorgedragen worden niet altijd gedeeld gezien de debatten die worden gevoerd. Deze debatten worden in dit proefschrift begrepen als een conflict tussen verschillende kennissystemen. Er is eerder sprake van een conflict dan van een consensus. Teneinde dit proces te analyseren, concentreerde het onderzoek zich op processen van voortbrenging en uitwisseling van kennis op het vlak van de selectie en vermeerdering van maïs variëteiten en de wijze waarop bodemvruchtbaarheid kan worden gerealiseerd.

De recente literatuur over technologie-ontwikkeling en technologische veranderingen voorziet in een aantal theoretische en methodologische handreikingen die overeenkomen met de reeds eerder geformuleerde theoretische uitgangspunten van het actor georiënteerde perspectief. Kenmerkend voor de recente theorievorming is dat technologie moet worden begrepen als technologisch als wel sociaal. Veranderingen zijn daarom socio-technisch van aard. Het begrip socio-technisch regime wordt gehanteerd om

een analytische brug te slaan tussen het sociale en het technologische en deze te verbinden met zowel het institutionele en ideologische kader als met de verschillende discoursen van technologie ontwikkeling. In dit verband spreekt de literatuur van socio-technische regimes hetgeen duidt op het naast elkaar bestaande en het zich tegelijkertijd voordoen van verschillende trajecten van ontwerpen en voortbrengen van technologie. Hiermee wordt het ook mogelijk om te analyseren hoe verschillende technologie trajecten zich door de tijd heen ontfouten. Een theoretisch en praktisch voordeel van het begrip socio-technisch regime is tevens dat afstand word genomen van lineaire opvattingen over technologische veranderingen. Dit proefschrift borduurt op deze inzichten voort en vat socio-technisch regime op als meervoudig of wel heterogeen en beschrijft veranderingen die zich op regime niveau af spelen als geïnitieerd 'van bovenaf', 'van binnenuit' en 'van onderaf'. Deze veranderingen werden voorheen geassocieerd met processen van samengaan, wederzijdse transformatie en distantiering.

Dezelfde literatuur beargumenteert ook dat het voor de studie van technologische verandering belangrijk is de taal van de technologie te begrijpen. Deze taal of discours wordt gebezigt in verschillende socio-technische netwerken en is verankerd in verschillende culturele en kennis repertoires. Een cruciaal aspect van een socio-technisch perspectief is derhalve dat de analyse van technologische verandering moet worden ingebed in de manier waarop de lokale bevolking hun dagelijks leven organiseren, in het bijzonder de wijze waarop het land wordt gebruikt en beheerd. Teneinde tot een goed begrip te komen van de keuzes die boeren maken ten aanzien van welke maïs variëteiten te planten en hoe de bodemvruchtbaarheid in stand te houden en te verbeteren, is het noodzakelijk de lokale cultuur te analyseren en technologie vanuit een etnografisch perspectief te bestuderen. De analyse moet zich tevens ook richten op de culturele repertoires van voorlichters, wetenschappers en andere actoren die een rol spelen in het ontwerpen en genereren van technologie. Op deze wijze verbindt het begrip socio-technisch regime het culturele en het sociale met artefacten zoals hybride maïs en bomen en struiken.

De opmerkelijke overeenkomst tussen het eerder geformuleerde actor perspectief om processen van sociale transformatie te bestuderen en de recente literatuur over socio-technische veranderingen, bevestigden niet alleen de ingeslagen weg, maar ook de methodologische afwegingen die zijn gemaakt. Een duidelijke keuze die in het onderzoek is gemaakt is die van een etnografische aanpak gecombineerd met de case-studie benadering, de verzameling van voor de analyse relevante verhalen van boeren en boerinnen en het interviewen van tal van actoren. Zoals eerder betoogd, is in detail aandacht geschonken aan het discours van voorlichters en wetenschappers.

Het proefschrift is in drie delen verdeeld. Het eerst deel omvat hoofdstukken Twee en Drie en beschrijven in detail vanuit een historisch en contemporaine perspectief welke veranderingen het landschap in de Siaya regio heeft ondergaan. De aandacht gaat hierbij vooral uit naar de ontmoetingen en de confrontatie van Luo normen en waarden met die van het Christendom alsmede met die van andere Afrikaanse etnische groeperingen en Europeanen. De Luo-landbouw is danig veranderd, niet alleen in de technische betekenis maar ook in de sociale en culturele zin. De hoofdstukken onderschrijven dat de Luo sterk verbonden zijn met land en dat land meer is dan alleen maar een beetje grond. Land en dus ook het gebruik ervan moet breder worden begrepen en in verband worden gebracht met complexe sociale verhoudingen die land met culturele, sociale en technische praktijken verbinden. Het case studie materiaal illustreert dat praktijken als *golo kodhi* (het als eerste zaaien) en *dwoko cham* (het als eerste oogsten) niet slechts de verhoudingen tussen vader en zoon en de daarin besloten liggende machtsverhoudingen reproduceert, maar tevens de keuze beïnvloedt wat betreft het gebruik van land. Hetzelfde case materiaal laat zien dat de arbeidsverhoudingen cruciaal en tegelijk problematisch van aard zijn. De Luo is een voorbeeld van een samenleving waar arbeid zich in voldoende mate voordoet, maar niet zo eenvoudig gemobiliseerd kan worden vanwege het feit dat ment niet zo graag wil werken voor andere families ondanks dat dat gebruikelijk is. De analyse van deze arbeidsrelaties door middel van het bestuderen van het onderhandelen en het her-onderhandelen aangaande de mobilisatie van arbeid, toont op zijn beurt het cruciale van *golo kodhi* en *dwoko cham* aan.

Het tweede deel onderzoekt het verschijnsel dat verschillende maïs variëteiten worden geplant. Hoofdstuk Vier analyseert de verschillende socio-technische netwerken waardoor maïs zich heeft verspreid in Luoland alsmede de regimes die deze variëteiten voortbrengen. Het Vijfde hoofdstuk laat zien dat de meeste boeren in de regio de maïs prefereren die ze zelf voortbrengen middels de *en masse* selectie en vermeerdering van lokale maïs. Deze maïs krijgt de voorkeur boven hybride en andere maïs variëteiten die door plantentelers worden voortgebracht. Een van de argumenten die de boeren aanvoeren voor deze keuze is dat ze niet (meer) geloven in de wijdverspreide mythe dat hybride maïs superieur is aan de lokale variëteiten; dit geldt in het bijzonder voor hen die meer vertrouwen hebben in de eigen maïs variëteiten en de daarmee verbonden sociaal-culturele praktijken. De laatste maken de kern uit van de socio-technische niches die in de loop der jaren zijn opgekomen in Luoland.

In beide hoofdstukken wordt aandacht geschonken aan lokale maïs. Deze is verankerd in lokale kennis die van generatie naar generatie wordt doorgegeven en voortkomt uit de lokale culturele repertoires. De richting van de *en masse*



selectie en vermeerdering van lokale maïs is vergeleken met die van de hybride maïs echter minder eenduidig en open eindig. De netwerken zijn voornamelijk lokaal, het experimenteer gehalte is hoog en een door iedereen geaccepteerd ontwerp is afwezig. De ontwikkelingen op de lange termijn zijn hoogstwaarschijnlijk afhankelijk van de bereidheid om ervaringen uit te wisselen.

Een gevoelig onderwerp dat deze analyse aansnijdt is dat de interactie tussen het moderne hybride regime en lokale maïs regime en door de jaren heen specifieke vormen heeft aangenomen. Een is dat de moderne, hybride maïs variëteiten die worden voortgebracht door de toepassing van wetenschappelijke kennis niet correspondeert met de culturele praktijken van de Luo. Hybride maïs wordt dan ook niet of nauwelijks meer gezaaid, en diegenen die nog steeds hybride maïs zaaien doen dit na tal van aanpassingen te hebben doorgevoerd. Een tweede aspect is dat de maïs variëteiten die heden ten dage worden geplant grotendeels afkomstig zijn uit de vermeerderingsprogramma's uit het begin van de 20ste eeuw en die zich zonder uitzondering buiten Kenia afspeelden (in Zuid Afrika en de Verenigde Staten). Deze variëteiten zijn via tal van socio-technische netwerken in de regio terecht gekomen, ook mede dankzij vroeg koloniale interventies. Het moderne hybride maïs regime daarentegen is er niet in geslaagd zijn missie te voltooien, aangezien hybride maïs niet of nauwelijks meer wordt geplant. Dit rechtvaardigt de conclusie dat de vroegere vermeerderingsprogramma's meer genetisch materiaal hebben toegevoegd aan de reeds bestaande genen pool dan de huidige moderne hybride maïs programma's. Aan deze constatering moet worden toegevoegd dat het hybride maïs regime niet alleen 'van onderaf' sterk in twijfel wordt getrokken, maar momenteel ook 'van binnenuit' wordt bekritiseerd en dat andere wijzen van het selecteren en vermeerderen van maïs recentelijk doen opgang in Kenia.

Het derde deel exploreert het complexe domein van bodemvruchtbaarheid en de strategieën om deze te verbeteren. Hoofdstuk Zes presenteert een overzicht van het bodemvruchtbaarheidsbeleid en de interventies gedurende de afgelopen 100 jaar. Dit hoofdstuk laat ondermeer zien hoe beleidswijzigingen op macro-economisch niveau en met name die op het vlak van kunstmest hun invloed doen gelden op het bodemvruchtbaarheidsbeheer in het gehele land. Na de 90er jaren is het beheer sterk beïnvloed door het structurele aanpassingsbeleid van de overheid. Devaluatie van de munteenheid, het loslaten van de prijsbeheersmechanismen van de overheid, de afschaffing van subsidies, de liberalisering van de import van landbouwbenodigdheden en landbouwkredietvoorziening en de afslanking van de overheid hebben geleid tot sterke prijsstijgingen van bijna alle landbouwbenodigdheden – vooral die van kunstmest – en zijn landbouwkredieten momenteel buiten bereik van veel kleine boeren. De case studies onderschrijven ook de niet beoogde effecten van

het structurele aanpassingsbeleid. Het gebruik van kunstmest, landbouwkrediet en andere diensten is immers flink terug gelopen. De liberalisering van de handel heeft ook de weg vrij gemaakt voor handelaren die de kunstmest aanlengen om meer winst te behalen zonder dat ze zich bekommeren om het effect op bodems. Dit is een van de factoren die mede verklaart waarom boeren afstand nemen van dit soort markten en diensten.

Boeren hebben als reactie op de afnemende bodemvruchtbaarheid eigen strategieën ontwikkeld. Deze komen overeen met hetgeen in het inleidende hoofdstuk als niches of als verborgen innovaties is omschreven. Deze niches opereren buiten het overheersende regime dat bodemvruchtbaarheid middels kunstmest in stand wil houden en verbeteren. Boeren laten delen van hun land gedurende tenminste een periode van zes maand braak liggen, recyclen organisch materiaal, passen gewasrotatie toe en voeren veelal ook een uitgekiend systeem van gewassen associatie uit. Meer radicalere strategieën behelzen het in cultuur brengen van laag gelegen moerasgebieden om er gewassen zoals groente te verbouwen die veel opbrengen op de markt.

De case studies die in hoofdstuk Zeven worden uitgewerkt, laten zien hoe boeren op zoek zijn naar andere alternatieven voor het bodemvruchtbaarheidsvraagstuk dat in hun ogen zowel de teelt van gewassen als de veeteelt raakt. De introductie en uitvoering van een door de Nederlandse regering mede opgezette en gefinancierde programma, het National Dairy Development Project (NDDP), wordt door boeren niet zozeer aangegrepen om (meer) melk voor de markt te produceren, maar wordt vooral gezien als een manier om de bodemvruchtbaarheid te verbeteren. Een groep boeren zag het 'zero-grazing' concept van NDDP als een uitstekende mogelijkheid om de interactie tussen landbouw en veeteelt te herstellen die grotendeels verloren is gegaan vanwege een sterke teruggang in het aantal koeien van het Afrikaanse ras Zebu. De opeenhoping van mest dat 'zero-grazing' met zich mee brengt, maakt een efficiënt gebruik van mest voor gewassenteelt weer mogelijk.

Hoofdstuk Acht richt zich voornamelijk op een analyse van recent geïntroduceerde technologieën die door wetenschappers maar ook door boeren zelf zijn ontwikkeld om de bodemvruchtbaarheid te verbeteren. Dit hoofdstuk voert aan dat boeren en onderzoekers zich vooral richten op het herstellen van de interacties tussen bomen, bodems en gewassen; interacties die verloren zijn gegaan en/of minder mogelijk zijn vanwege de ontbossing die op zijn beurt vooral te wijten is aan de groei van de bevolking in de regio. Deze technologieën die tot doel hebben de bodems te verbeteren en de vruchtbaarheid te herstellen baseren zich op biologische en natuurlijke processen en niet of nauwelijks middels het toevoegen van kunstmest. Dit wordt door onderzoekers ook wel als het Tweede Bodemvruchtbaarheidsparadigma bestempeld. Dit paradigma scharniert overwegend om

braakligging in combinatie met het planten van bomen, struiken en peulvruchten die stikstof binden via de wortels en biomassa middels de bladeren voortbrengen. Dit wordt ook wel verbeterde braakligging genoemd. Het transporteren van biomassa is een andere veelbelovende technologie om de bodemvruchtbaarheid te herstellen om zodoende tot een hogere productie per eenheid land te komen. Dit soort biomassa wordt vooral verkregen van *Tithonia diversifolia* dat veel voorkomt in de vele heggen die aangeplant zijn in de regio. In tegenstelling tot de Groene Revolutie technologieën die in de vorm van een pakket van benodigdheden en voorschriften die slechts via de markt kunnen worden verkregen, komt de biologische bodemverbetering vooral voort uit de zoektocht van boeren zelf. Boeren keren steeds vaker de markt de rug toe en wenden zich tot de eigen natuurlijke omgeving voor hulpbronnen. Land- en bosbouw gecombineerd in agro-forestry, schrijven geen pakket voor, hetgeen ruimte schept voor eigen experimenten. Agro-forestry kan derhalve worden gezien als technologie dat voorkomt uit een technologisch ontwerp dat boeren die zich afwenden van de markt ondersteund en dit streven mogelijk maakt. Dit is bovenal van belang voor boeren met beperkte hulpmiddelen als land en kapitaal.

Het Negende en laatste hoofdstuk zet de belangrijkste theoretische argumenten op een rij en vat de belangrijkste bevindingen van het proefschrift samen. Ook wordt kort stil gestaan bij de constatering dat niet slechts onderzoekers zich realiseren dat boeren zich van de markt en de middels deze gegenereerde technologische innovaties. Ook de Keniaanse Staat en NGO's hebben dit opgemerkt, maar deze reageren echter verschillend op dit fenomeen. Over het algemeen kan worden gesteld dat de huidige Staat er zich niet of nauwelijks iets van aantrekt. De Staat heeft (nog steeds) een hoge pet op van de in haar ogen superieure hybride maïs variëteiten. Ook de top-down structuur van de overheid speelt een rol. De bureaucratische structuur belemmert dat ervaringen van boeren met hybride maïs of nauwelijks bij beleidsmakers doordringen. Zelfs als dit het geval zou zijn, zou de Staat mede met verwijzing naar de superioriteit van de hybride variëteiten niet afwijken van haar beleid dat zich richt op voedselzekerheid op nationaal niveau en de voortbrengen van buitenlandse valuta. Ook dient opgemerkt te worden dat een reeds sterk afgeslankte overheid over weinig menskracht beschikt om adequaat te reageren.

NGO's of NGO-achtige instituties hebben zich in tegenstelling tot de Staat door boeren op sleeptouw laten nemen. Diensten die sommige NGO's verlenen staan zelfs in dienst van boerenstrategieën gericht op het distantiëren van de markt. Twee redenen kunnen hiervoor worden aangevoerd. NGO's zijn beduidend minder bureaucratisch georganiseerd en derhalve veel flexibeler en sneller in staat om hun programma's en projecten aan te passen aan wat boeren

doen. Een tweede reden is dat NGO's niet zozeer gestuurd worden door macro-economische doelstellingen hetgeen het makkelijker maakt om aan te sluiten bij wat er leeft onder de rurale bevolking. Mede hierdoor hebben NGO's zich voor het karretje van boeren laten spannen. De realiteit gebiedt het echter ook te constateren dat boeren zich ook voor het karretje van NGO's hebben laten spannen. NGO's hebben boeren ervan overtuigd dat het planten van stikstof bindende struiken, het transporteren van biomassa en de verbeterde braakligging een goede manier zijn om de bodemvruchtbaarheid te verbeteren.

De vraag die zich nu opwerpt is hoe nu de toekomst van de landbouw in Luoland er uitziet of moet zien. In een poging deze te beantwoorden stel ik een tweesporen beleid voor dat zowel boeren en hun families ondersteunt die 'van onderaf' en nu nog vooral op eigen kracht technologische veranderingen nastreven alsmede boeren ondersteunt die willen voorborduren op technologische vernieuwingen die 'van bovenaf' en 'van binnen uit' worden gestimuleerd. Naast hybride maïs en kunstmest moet het mogelijk zijn om de selectie en vermeerdering van zowel *open pollinated* als lokale variëteiten en om alternatieve, op organische en biologische processen gestoelde technologische innovaties voor bodemvruchtbaarheid te faciliteren. Dit is vooral van belang voor die boeren die het vertrouwen in de markt hebben verloren. Een laatste, wellicht overbodige, opmerking die gemaakt dient te worden is dat economische ontwikkeling niet alleen moet verlopen via de stimulering van de landbouw en de agrarische productie middels technologische vernieuwing. De toekomst van de rurale bevolking en van de landbouw hangt mede af van de mogelijkheid om in de regio werkgelegenheid buiten de landbouw te stimuleren. Dit vereist een politieke en economische aardverschuiving op het nationale en globale vlak die voor de onmiddellijke toekomst niet in de lijn der verwachting ligt.



# Glossary

<i>Ajuoga</i>	Diviner
<i>Busaa</i>	Local beer made from sorghum and millet
<i>Chira</i>	A disease with unknown consequences as a result of folk punishment
<i>Chwoyo</i>	General sowing
<i>Dala</i>	Home, enclosure, homestead, compound
<i>Dholuo</i>	Luo language
<i>Dhoot</i>	Clan
<i>Dwoko cham</i>	First harvesting/bringing the first harvest back home
<i>Fwachra/gwelruok</i>	A feast meant to welcome the new harvest and to honour the ancestors
<i>Golo kodhi</i>	First sowing
<i>Gorogoro</i>	Empty tin used as a measure of volume
<i>Goyo ligala</i>	Cutting a new foundation or building a new home
<i>Gunda</i>	Deserted old home or enclosure
<i>Gunda bur</i>	Ancient concentrated and fortified settlements
<i>Gweng</i>	Village, neighbourhood, countryside settlement
<i>Jadak</i>	A person (stranger) who comes to live in an area of a clan other than his
<i>Jaduong</i>	An elder
<i>Jaduong dala</i>	Homestead head
<i>Jaduong gweng</i>	Village head
<i>Jagol pur/kodhi</i>	The most senior elder person within a lineage who is the first to sow
<i>Jater</i>	A person who inherits a widow
<i>Jawagundia</i>	A person (stranger) who comes to inherit a widow in a clan other than his own
<i>Jembe</i>	English hoes
<i>Jodongo</i>	Elders
<i>Jokadayo</i>	People descended from the same grandmother
<i>Jokamiyo</i>	People affiliated to the mother rather than to the father per se
<i>Jokakwaro</i>	People descended from the same grandfather
<i>Jokawuoro</i>	People of the same father
<i>Keyo</i>	Extended polygamous families tracing descent from a common great-grand father third to fifth generations back
<i>Kipande</i>	An identity card mandatory for persons of 18 years and above

<i>Koth dala</i>	Family seeds
<i>Lemo mar buru</i>	A special mass offered a month before sowing to secure good harvest from the seeds
<i>Ligala</i>	A new homestead or compound
<i>Limbaba</i>	Descendants of a common ancestor four to seven generations back
<i>Manyasi</i>	A herbal concoction used to cure or prevent chira
<i>Migumba</i>	A woman without a male child
<i>Mikaye</i>	First wife
<i>Nyachira</i>	Second wife
<i>Misumba</i>	A servant or slave
<i>Mondo</i>	Homestead head's garden or father's garden
<i>Nyareta</i>	Seeds from outside that do not belong to the family
<i>Nyiego</i>	Jealousy or rivalry (as among co-wives)
<i>Nyi-udi</i>	Women married after the third wife
<i>Opanga</i>	Machette
<i>Rahaya</i>	Wooden hoe
<i>Reru</i>	The third wife
<i>Rika</i>	People of the same age group
<i>Saga</i>	Community labour support
<i>Theno Kendo</i>	First liberation that allows a woman to cook in her own house
<i>Ugali(Swahili)</i>	Steamed maize meal
<i>Uji (Swahili)</i>	Porridge
<i>Weg Lowo</i>	The rightful owners of the land that they occupy

## Curriculum Vitae

Nelson Mango was born in Siaya District, Kenya, where he attended both primary and secondary school before proceeding to advanced level secondary education in the Rift Valley Province. In 1987, he joined Egerton University, Njoro, where he graduated with a BSc (Hons.) in Agricultural Education and Extension in 1990. He then returned to Siaya to teach agriculture in Nyawara Girls School. In 1994, he won a Netherlands Fellowship Programme scholarship to study for a Master of Science degree in the Management of Agricultural Knowledge Systems, at Wageningen Agricultural University. After gaining the Masters degree he returned to Siaya to continue with his teaching career at Nyawara Girls School and to lay the groundwork for a future Ph.D. project. In 1997, this materialised when he was awarded a Sandwich scholarship by Wageningen University and Research Centre to study in the Department of Rural Development Sociology. During Ph.D. fieldwork, he continued to teach agriculture in Nyawara Girls School. He has also undertaken collaborative designed research projects with other organisations. Some of these include:

- 1999-2000: A socio-economic assessment of food security and local livelihood strategies in small holder farms in Siaya District: Best practices for Policy support. Sponsored by the Department of Social Sciences. Wageningen University and Research Centre.
- 1998-1996: A sociological analysis of farmers' integrated soil fertility management practices in Siaya District. Sponsored by Nutnet (Networking on soil fertility management).

Some of his academic work and publications include:

- Mango, N., 1996, Farmers Responses to the Agrarian Crisis in Siaya District, Kenya. An analysis of how farmers 'Internalise' induced technology interventions in Dairy farming. Unpublished MSc Thesis, Wageningen Agricultural University
- Mango, N., 1999, Integrated Soil Fertility Management in Siaya District, Kenya. Managing Africa's Soils No.7. NUTNET Publication, Russell Press, Nottingham, United Kingdom. (Download: <http://www.iied.org/drylands>)
- Mango, N., 2002, Integrating Dairy Farming into the existing farming systems in Siaya District, Kenya. In: Low External Input and Sustainable Agriculture (LEISA) magazine (forthcoming)



- Hebinck, P. and N. Mango, 2001, Kinship Relations and Land inheritance among the Luo of Western Kenya. In: Anderson, J.A. and M. Breusers (eds), Kinship structures and enterprising actors: Anthropological essays on development. Liber amicorum Jan den Ouden. Wageningen. Ponsen & Looijen BV
- Mango, N. and P. Hebinck, 2002, Cultural repertoires as a technological regime, a case study of local and modern varieties of maize in Luoland, Kenya. In: Ploeg, J.D. van der and H. Wiskerke (eds), The dynamics of agricultural innovation at the interface of novelty creation and socio-technical regimes (forthcoming)